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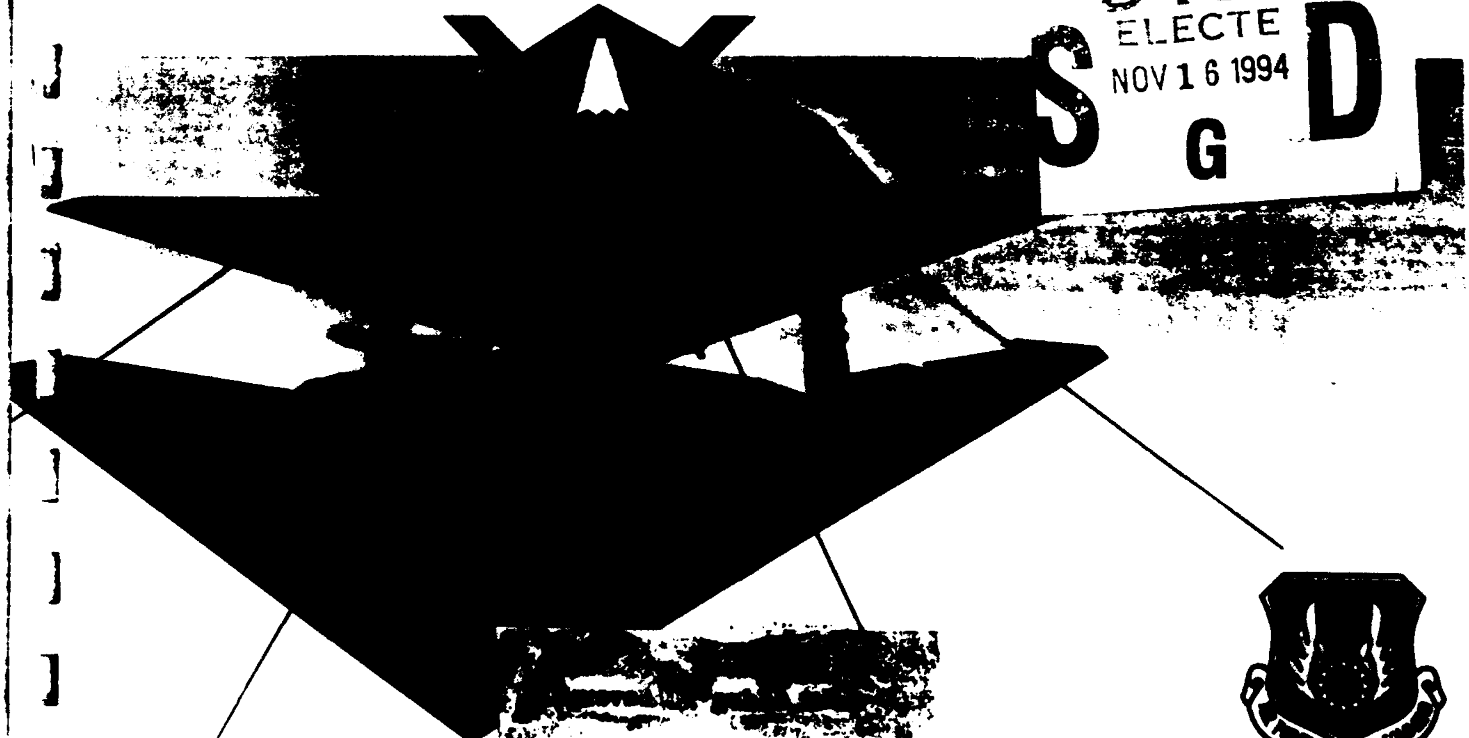
McClellan Air Force Base

Draft <u>Final</u> Copy
Interim Record of Decision
Davis Global Communications Site



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Draft Final Copy
Interim Record of Decision
Davis Global Communications Site

Prepared for

McClellan Air Force Base
Contract No. F04699-93-D-0017
Delivery Order 7013
Line Item 6.5.5

1263

94-34345

Prepared by

CH2M HILL
2485 Natomas Park Drive, Suite 600
Sacramento, California 95833

SWE70246.13.RP

~~July 18~~, October 21, 1994

DEPARTMENT OF THE AIR FORCE

HEADQUARTERS SACRAMENTO AIR LOGISTICS CENTER (AFMC)
McCLELLAN AIR FORCE BASE, CALIFORNIA

OCT 2 1 1994

MEMORANDUM FOR SEE DISTRIBUTION

FROM: SM-ALC/EMR
5050 Dudley Blvd, Suite 3
McClellan AFB CA 95652-1389

SUBJECT: Draft Final Copy, Interim Record of Decision (IROD), Davis Global Communications Site

The subject document is forwarded to you for your review. Comments on the draft copy have been incorporated. This document is identified as a primary document according to the guidelines in the Federal Facilities Site Remediation Agreement (FFSRA).

Please forward any comments by 22 Nov 94. If you have any questions, please contact Marc Garcia or the undersigned at (916) 643-0830, ext 167 or 145 respectively.

For DORIS K. BAJKA
Remedial Program Manager, Davis Site
Environmental Restoration Division
Environmental Management Directorate

Attachment:
Draft Final IROD

cc:
McClellan Admin Record

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* These should be sent 7 to 10 days before reports are released to the regulatory agencies.

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Abbreviations and Acronyms

ARCH	air-rotary casing hammer
AWQC	ambient water quality criteria
BACT	Best Available Control Technology
Basin Plan	Water Quality Control Plan
bgs	below ground surface
Cal-EPA	California Environmental Protection Agency
Cal-OSHA	California Division of Occupational Safety and Health
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFM	cubic feet per minute
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
CPT	Cone Penetrometer Test
CRP	Community Relations Plan
CVRWQCB	Central Valley Regional Water Quality Control Board
Davis Site	Davis Global Communications Site
1,1-DCE	1,1-dichloroethylene
1,2-DCE	1,2-dichloroethylene
DTSC	Department of Toxic Substances Control
EDB	ethylene dibromide - a soil fumigant
FS	Feasibility Study

GAC	granular activated carbon
gpm	gallons per minute
HCl	hydrogen chloride
HI	Hazard Index
HSWA	Hazardous and Solid Waste Amendments
ILCRs	increased lifetime cancer risks
IROD	Interim Record of Decision
IRP	Installation Restoration Program
ITC	International Technology Corporation
LEL	lower explosive limit
McClellan AFB	McClellan Air Force Base
MCLs	Maximum Contaminant Levels
NCP	National Oil and Hazardous Substances Pollution ~~Control~~ Contingency Plan
NOAELs	no-observed-adverse-effect levels
OSHA	Occupational Safety and Health Administration
PCE	tetrachloroethylene
ppbv	parts per billion by volume
RCRA	Resource Conservation and Recovery Act
RfDs	Reference Doses
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act of 1986

SCFM	standard cubic feet per minute
SCOCs	subset of COCs
SFs	slope factors
SVE	soil vapor extraction
SVMW	soil vapor monitoring well
SWRCB	State Water Resources Control Board
TBCs	~~to be considered~~ To-Be-Considered criteria
TCE	trichloroethylene
THM	trihalomethanes
TI	Technical Impractibility
TPH	total petroleum hydrocarbons
UCL	upper confidence limit
UV	ultraviolet
VOC	volatile organic compound
YS~~APCD~~ QMD	Yolo-Solano Air ~~Pollution Control~~ Quality Management District

1.0 Declaration

1.1 Site Name and Location

McClellan Air Force Base Davis Global Communications Site Annex, Yolo County, California. The address for the site is:

652 CCSG Communications Computer Systems Group
44960 County Road 36
Dixon, California 95620

1.2 Statement of Basis and Purpose

This Interim Record of Decision (IROD) presents the selected remedial action for the Davis Global Communications Site (Davis Site), Yolo County, California, that was chosen following guidance established in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This IROD explains the factual and legal basis for selecting the remedy for the Davis Site. The remedy selection is based on the administrative record for this site. The U.S. Air Force has selected a remedy with the concurrence of the State of California, as represented by the Regional Water Quality Control Board (RWQCB) and the Department of Toxic Substances Control (DTSC).

Section 25356.1(d) of the California Health and Safety Code requires that a Remedial Action Plan approved by DTSC include a non-binding preliminary allocation of financial responsibility among all identifiable potentially responsible parties. This IROD fulfills the requirements of a Remedial Action Plan. Upon consideration of all the evidence, DTSC has concluded that the preliminary non-binding allocation of financial responsibility in this IROD is as follows:

- U.S. Air Force, McClellan Air Force Base (McClellan AFB) Davis Global Communications Site–100 percent

The content of this IROD is based on recommendations from the EPA Record of Decision Checklist for Interim Groundwater Actions (EPA, 1993), and EPA guidance for preparing Superfund Decision documents (EPA, 1989).

1.3 Assessment of the Site

The Davis Site is an annex of McClellan AFB in Sacramento, California. It is located approximately 4 miles south of the City of Davis, California. The Davis Site is staffed 24 hours a day by members of the 2049th Communications Squadron, which operates out of McClellan AFB. Investigations conducted as part of the U.S. Air Force Installation Restoration Program (IRP) identified subsurface soil and groundwater contamination. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the interim remedial action selected in the IROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

1.4 Description of the Selected Remedy

The selected remedy will address the volatile organic compound (VOC)-contaminated soil and groundwater at the Davis Site. The following are objectives of the selected remedy:

- **Contain groundwater contamination above MCLs in the B and C groundwater zones.**

- **Reduce or eliminate levels of subsurface contamination that pose a potential threat to human health or the environment**

- **Prevent the spread of groundwater contamination beneath the site, especially to regional aquifers**

The following are the major components of the selected remedy:

- **Soil vapor extraction (SVE) ~~and treatment~~ of VOCs ~~in~~ from the vadose zone.** The SVE system will consist of three to six soil vapor extraction wells connected to a blower system capable of a minimum of 200 scfm airflow.

- **Treatment of VOCs extracted from the vadose zone.** The soil vapor from the extraction wells will be collected near the blower and treated using granular activated carbon. The treated air will be discharged to the atmosphere. Soil VOC contamination will be removed to levels below which it no longer will be a continuing source of groundwater contamination.

- **~~Groundwater~~ ~~e~~Extraction~~, treatment with ultraviolet (UV) oxidation, and end-use~~ of contaminated groundwater occurring within approximately 150 feet of the land surface beneath the site.** The groundwater ~~remedial action~~ extraction system will consist of ~~four~~ three to six groundwater extraction wells pumping a total of up to 400 gpm from the B and C zones.

- **Treatment of extracted groundwater with ultraviolet (UV) oxidation.** The extracted groundwater will be conveyed to a groundwater treatment system consisting of an advanced UV oxidation treatment unit followed by a carbon polishing treatment unit.

- **End use of treated groundwater.** The treated groundwater will be conveyed to one of two injection wells where it will be injected into the E zone and lower groundwater.

- Groundwater contamination above ~~detection limits~~ (MCLs) will be ~~targeted~~ addressed in this interim remedy.

To document full containment of the B and C zone groundwater, ~~and capture,~~ the Davis Site remedy requires ~~extensive~~ groundwater monitoring and supplemental data gap analysis to determine if additional response actions are needed to ensure full ~~capture of contamination~~ containment.

1.5 Statutory Determinations

The selected interim remedy satisfies statutory requirements by achieving the following:

- Being protective of human health and the environment.

- Complying with federal and state applicable or relevant and appropriate requirements for this limited scope action.

- Being cost-effective.

- Using interim action treatment. ~~Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does use treatment and therefore furthers that statutory mandate.~~

~~Because this action does not constitute the final remedy for the Davis Site, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. The need for further actions to evaluate the potential threats posed by conditions at the Davis Site will be evaluated following implementation of this interim remedy. Because this remedy may result in hazardous substances remaining onsite above health-based levels, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within 5 years after commencement of the remedial action. Because this is an interim action IROD, review of this site and of this remedy will be ongoing as the U.S. Air Force McClellan AFB continues to develop final remedial alternatives for the Davis Site.~~

Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action uses treatment consistent with the final anticipated remedy and furthers that statutory mandate. Because this action does not constitute the final remedy for the Davis Site, the statutory preference for remedies that employ treatment to reduce toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. Following implementation of this interim action, McClellan AFB, in cooperation with the California Environmental Protection Agency (Cal-EPA) will re-assess conditions at the Davis Site to identify the need for further actions to protect human health and the environment. Remedial action goals have been developed for this interim action based on Federal and State requirements. The remedial action goals that have been developed for this interim action are to protect the present and anticipated beneficial uses of groundwater. As implied in the definition of the interim action, these remedial action goals are non-binding, and the technical and economic feasibility of achieving these goals will be reevaluated by McClellan AFB, in cooperation with Cal-EPA, before implementation of the final response action. This interim action will be reviewed within 5 years of signing the IROD to ensure adequate protection of human health and the environment. Within 5 years of signing the IROD McClellan AFB, in cooperation with Cal-EPA, will develop final remedial action goals and final remedial action alternatives for the Davis Site.

Sacramento Air Logistics Center Vice Commander	Date
Anthony J. Landis, P.E. California Environmental Protection Agency Department of Toxic Substances Control Chief of Operations Office of Military Facilities	Date
William H. Crooks California Environmental Protection Agency Central Valley Regional Water Quality Control Board Executive Office	Date

~~Note: Signatures to be identified by Draft Final IROD.~~

2.0 Decision Summary

2.1 Site Name, Location, and Description

The Davis Site is an annex of McClellan AFB in Sacramento, located approximately 4 miles south of the City of Davis, as shown in Figure 2-1. The site was built in the 1950s and covers approximately 316 acres in Yolo County, and is surrounded by farmland. A 320-acre parcel located adjacent to the west portion of the Davis Site was ceded to Yolo County in 1973 for development as Wilson Park. Currently, part of Wilson Park is leased to an archery club, a horseshoe club, and a dog training club. The remainder is open grassland.

The Davis Site consists of the fenced Main Compound Area (approximately 8 acres), as shown in Figure 2-2, communication antennas, and undeveloped grasslands. The Davis Site is staffed 24 hours a day by the 2049th Communications Squadron, which operates out of McClellan AFB, approximately 20 miles to the northeast.

Most of the known soil and groundwater contamination is located within the fenced compound area and extends up to 1,000 feet south of the fenced compound area.

2.1.1 Land Use

The Davis site currently occupies approximately 316 acres that are largely surrounded by farmland. Immediately adjacent to the site on the west is Wilson Park, a 320-acre parcel that was formerly part of the Global Communications Site. Operational facilities and controls are located within a fenced compound located near the center of the site. Outside the fence are over 2 dozen antennas and transmitters. An access road to the controlled-access compound area runs to County Road 36, which borders the southern edge of the site.

2.1.2 Location with Regard to Population Centers

Wilson Park, the El Macero area, and the Davis Migrant Center are the population centers closest to the site. Currently, part of Wilson Park is leased to an archery club, a horseshoe club, and a dog training club. The remainder of the park (170 acres) is grassland. The only apparent residential area is the El Macero area, which is bounded by Mace Boulevard to the west and Interstate 80 to the north, and is located approximately 4 miles to the northwest of the site. The Davis Migrant Center, a migrant farmworker camp, is located immediately to the southeast of the site (approximately one-half mile from the main compound) at the intersection of Road 36 and Road 105, (as shown in Figure 2-1). The Migrant Center is downgradient of the Davis Site groundwater contamination. Structures (possibly including residences) are located immediately to the southeast and south of Wilson Park, approximately 1,500 to 1,800 feet from the border of the Davis Site.

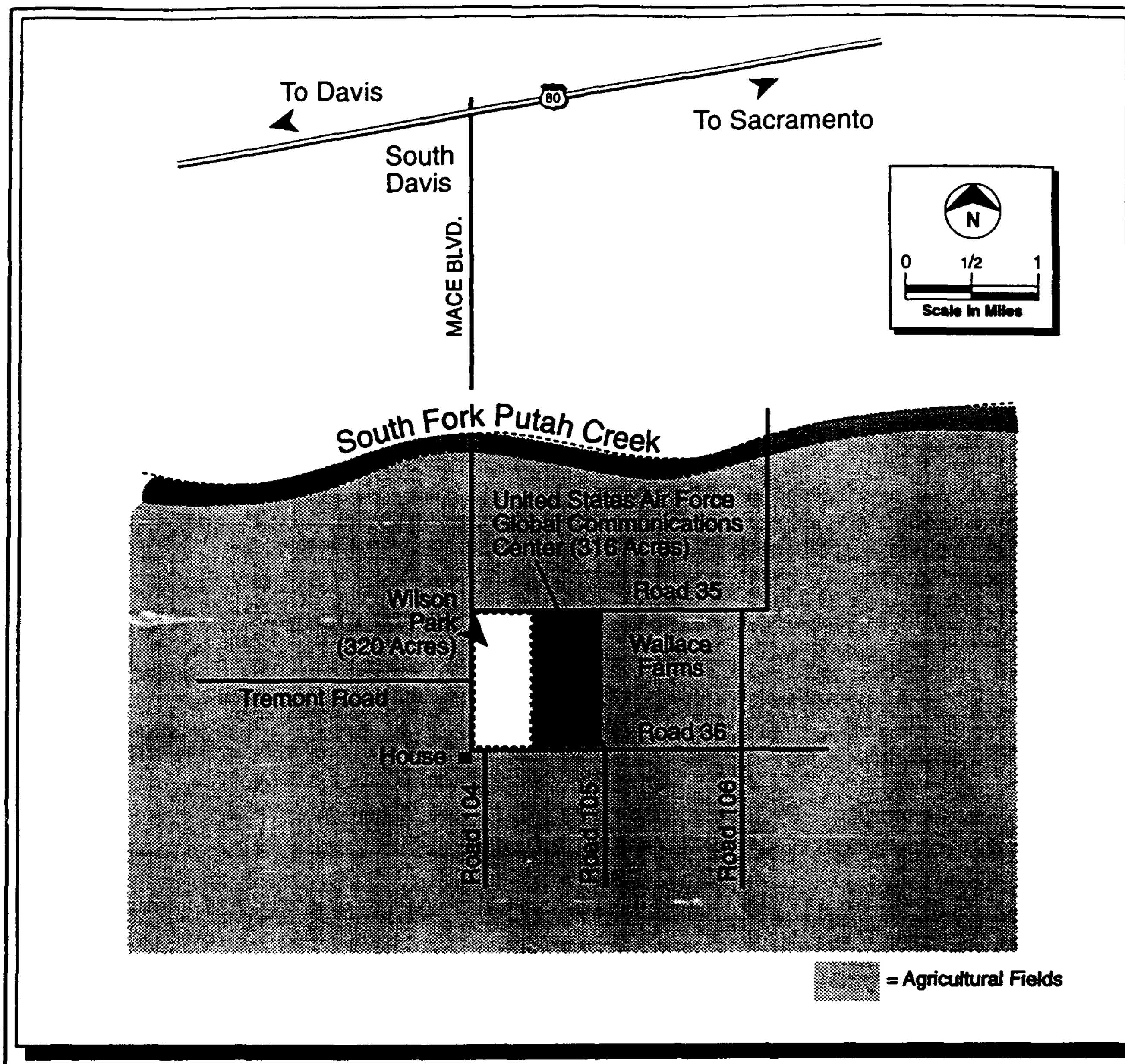
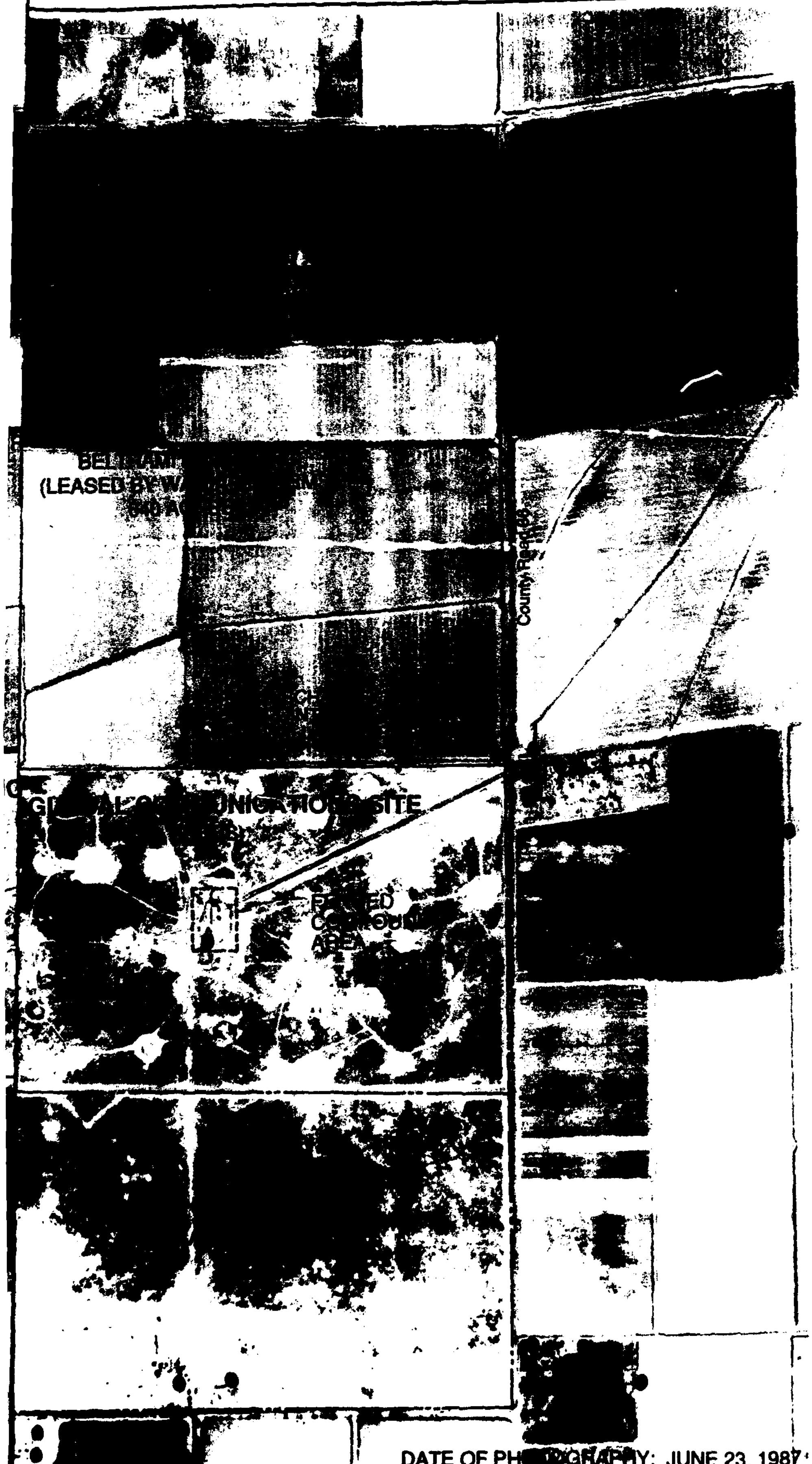


FIGURE 2-1
SITE MAP
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

RDO1590_03

CH2M HILL


County Road 35
County Road 104



600 0 600 1200 FEET

LEGEND

● WATER SUPPLY WELL OR IRRIGATION WELL SAMPLED FOR VOCs DURING 1988

DATE OF PHOTOGRAPHY: JUNE 23, 1987

FIGURE 2-2
DAVIS GLOBAL COMMUNICATIONS SITE VICINITY
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

CH2M HILL

2.1.3 Groundwater Resources

The use of groundwater in the vicinity of the Davis Site can be divided into local and regional components. Shallow groundwater, less than 150 feet below ground surface (bgs), is considered a local resource and uses include stock watering and potential domestic supply. Regional groundwater zones occur below 150 feet bgs and are used extensively for crop irrigation. There are several large-diameter agricultural production wells in the vicinity of the Davis Site (Figure 2-2).

Groundwater levels and flow directions vary greatly beneath the site. Regional and local vertical and horizontal groundwater gradients are influenced by agricultural pumping during the irrigation season from April to October. Groundwater levels typically fluctuate 40 feet or more per year, and strong downward gradients, caused by pumping agricultural wells in the vicinity of the site, exist during the growing season. The agricultural wells are typically 200 to 500 feet deep. Winter groundwater levels approach mean sea level (msl), about 30 feet ~~below land surface~~ bgs, and summer levels drop to lower than ~~-40~~ 70 feet ~~msl~~ bgs. During recharge in the winter, gradients are slightly upward.

Prior to agricultural development, groundwater flowed eastward from the Coast Range toward the discharge point at the Sacramento River east of the site. However, a groundwater pumping depression has existed for over 60 years near Dixon, California, southwest of the site, which causes regional gradients in the vicinity of the site to be primarily toward the south-southwest rather than east.

The stratigraphy underlying the site has been divided into five zones: A, B, C, D, and E. The five zones extend to a depth of approximately 245 feet below the site. While the depth and thickness of all zones varies within the area of contamination, stratigraphic borings indicate that generally these zones exist across the site. Each zone contains both permeable aquifer materials and low permeability aquitard materials. The A zone (vadose zone) extends from ground surface to 65 feet below ground surface (bgs); the B zone extends from 65 to 95 feet bgs; the C zone extends from 95 to 145 feet bgs; the D zone extends from 145 to 195 feet bgs; and the E zone extends from 195 to 245 feet bgs. The size and occurrence of coarse-grained materials increases with depth at the site. The D and E zones are considered to be part of regional aquifers. Most agricultural wells are screened ~~in~~ across the D and deeper zones.

Horizontal groundwater gradients in the B and C zones are virtually the same. During times of agricultural pumping, the gradients are predominantly south to southwest at a magnitude of 0.005 ft/ft. During this same time period, horizontal gradients in the D and E zones respond to agricultural pumping adjacent to the site, and directions are typically east to southeast at a magnitude of 0.002 ft/ft.

2.2 Site History and Enforcement Activities

2.2.1 Investigation History

Ten borings drilled by J.H. Kleinfelder & Associates in 1985 identified soil contamination in the vicinity of three underground diesel fuel tanks. The tanks were exposed, and damage to at least one tank and associated piping was evident. The tanks were then drained and covered with clean fill dirt; they were removed in 1988.

In 1987, an investigation performed by International Technology Corporation (ITC) confirmed the presence of hydrocarbon contamination in the vicinity of the storage tanks to a depth of 55 feet bgs and determined that the groundwater beneath the site had been contaminated with VOCs (Radian Corporation, 1990). This investigation included seven additional soil borings and installation of eight groundwater monitoring wells.

In subsequent investigations by ITC, trichloroethylene (TCE) and tetrachloroethylene (PCE) were found in vapors collected from soil vapor surveys to depths of 10 feet and in groundwater as deep as 225 feet bgs. These investigations included 19 Cone Penetrometer Test (CPT) soundings, 11 soil borings, Hydropunch sampling at CPT locations, installation of 17 additional monitoring wells, and a soil gas survey.

Since 1992, CH2M HILL has conducted field investigation activities. These activities have included the following:

- Collecting 71 soil gas samples and 14 soil pile samples
- Installing 5 soil vapor monitoring wells (SVMWs), 12 soil vapor piezometers, 12 groundwater monitoring wells, and 6 groundwater extraction wells
- Conducting 6 aquifer tests and 3 air permeability tests

Continuing field activities include installation and testing of injection wells, additional soil gas sampling and SVMW installation, and soil sampling for herbicides.

A chronology of field investigation activities conducted at the Davis Site since 1985 is shown in Figure 2-3. The activities are divided into three portions: soil, groundwater, and soil gas. Also provided is the name of the contractor who performed the study. A summary of sampling events at the site is provided in Table 2-1. A map of the wells onsite is included as Figure 2-4.

Soil Samples from MW-
Monitoring Wells
ITC (9/87-10/87)

MW- Series Wells
ITC (10/87)

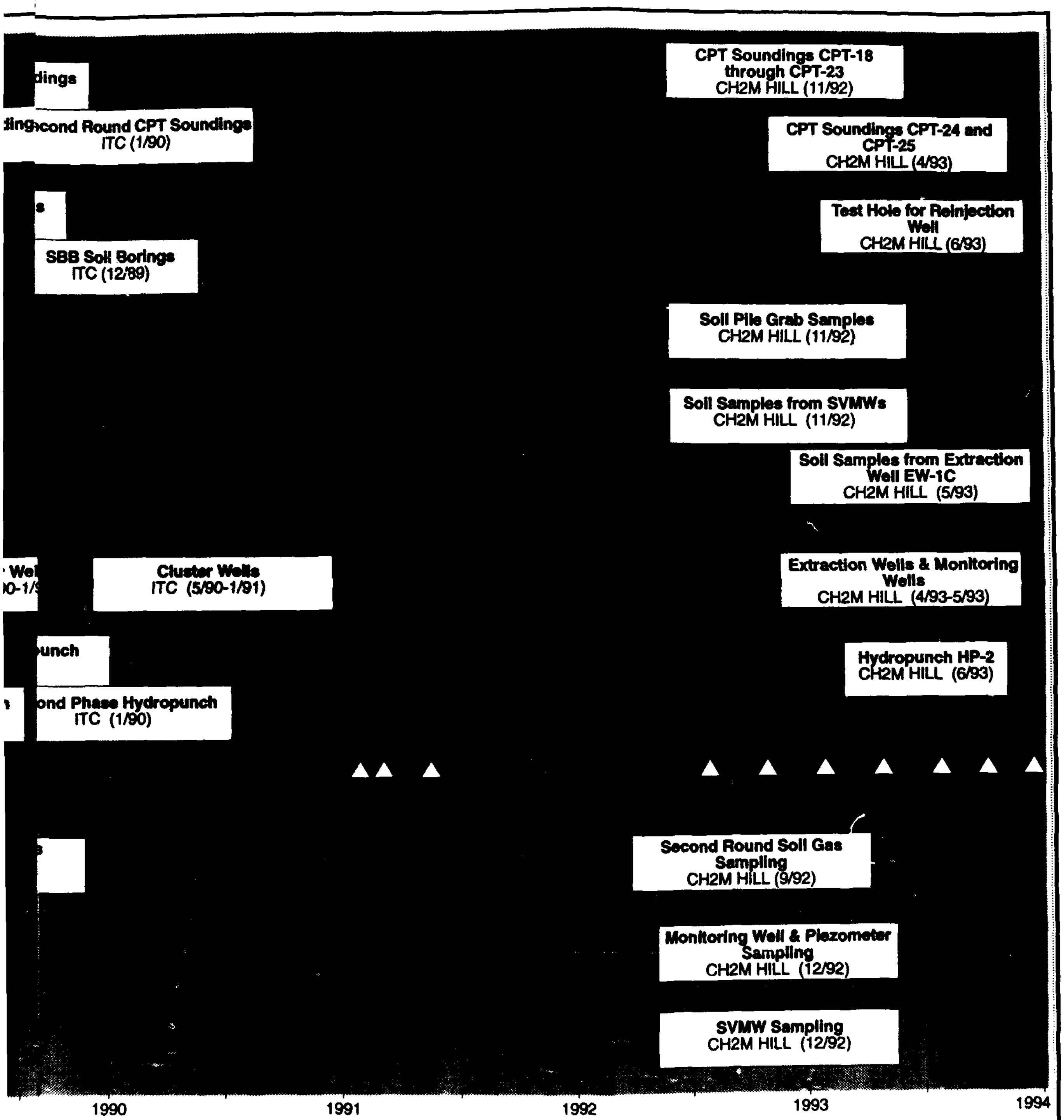


FIGURE 2-3
CHRONOLOGY OF FIELD ACTIVITIES
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

CH2M HILL

Table 2-1
Summary of Field Investigation Activities

Description Activity	Designation	Total Depth (feet bgs)	Analyses Performed	Contractor (Date Sampled)	Reference
SOIL (Soil Borings, Cone Penetrometer (CPT) Soundings, Soil Sampling during Drilling of Monitoring Wells, and Sampling of Soil Piles)					
1. B- Series Soil Borings	B-1 through B-10	38.5 to 56.5	EPA418.1 (TPH) SW8240 (VOCs)	Kleinfelder (10/85)	ITC
2. BB- Series Soil Borings	BB-11 through BB-17	71.5 to 84.5	SW8015 (TFH Diesel) SW8020 (BTEX)	ITC (8/87-9/87)	ITC
3. Soil Samples Collected from MW- Series Monitoring Wells	MW-1 through MW-8	80.5 to 84.0	EPA 602 (BTEX) SW8015 (TFH Diesel) SW8020 (BTEX)	ITC (9/87-10/87)	ITC
4. Tank Pull Grab Samples	EM3952 through EM3963	Not Measured	SW6010 (ICP Metals) SW8010 (VOCs) SW8015 (TFH Diesel) SW8020 (BTEX) SW8270 (Semi VOCs)	McClellan (5/88)	ITC
5. 1st Round CPT Soundings	CPT-1 through CPT-4 and PCPT-1 through PCPT-5	119 to 125	Not Applicable	ITC (55/89)	ITC
6. Stratigraphic Soil Borings	THD-1 through THD-4	280	Geophysical Logging	ITC (4/89)	ITC
7. MWD-Well Borings	THD-11 through THD-14	300	Geophysical Logging	ITC (11/90)	
8. SBB- Series Soil Borings	SBB-18 through SBB-24	155.5	SW8015 (TFH Diesel) SW8240 (VOCs)	ITC (12/89)	ITC
9. 2nd Round CPT Soundings	PCPT-6, -7,and -10 through -17	48 to 168	Not Applicable	ITC (1/90)	
10. Soil Samples Collected from SVMWs	CH-1 through CH-5	61.5 to 71.5	ASTM D 2216 (Moisture Content) ASTM D 2937 (Bulk Density) ASTM D (Specific Gravity) EPA 418.1 (TPH) SW6010 (ICP Metals) SW7421 (Lead) SW7471 (Mercury) EPA 415.1M (TOC)	CH2M HILL (11/92)	CH2M HILL

G:\users\da\emr\davmain\TAB2-1.XLS

Table 2-1
Summary of Field Investigation Activities

Description Activity	Designation	Total Depth (feet bgs)	Analyses Performed	Contractor (Date Sampled)	Reference
11. Grab Samples from Ex Situ Soil Piles	ESP-1 through ESP-9 and NSP-1A, NSP-1B, NSP-2A, NSP-2B, and NSP-3	0 to 1	EPA 418.1 (TPH) SW8015 (TFH Diesel)	CH2M HILL (11/92)	CH2M HILL
12. Cone Penetrometer Soundings	CPT-18 through CPT-23	50 to 100	NA	CH2M HILL (11/92)	CH2M HILL
13. Cone Penetrometer Soundings	CPT-24 through CPT-25	72 to 73	NA	CH2M HILL (4/93)	CH2M HILL
14. Soil Samples from Extraction Well	EW-1C	81 to 83	EPA8020/8010 (VOCs/BTEX)	CH2M HILL (5/93)	CH2M HILL
15. Test Hole for Reinjection Well	TH-1	270	Geophysical Logging	CH2M HILL (6/93)	CH2M HILL
WATER (Groundwater Sampling from Monitoring Wells and Hydropunch)					
16. MW- Series Wells	MW-1 through MW-8	58 to 81	SW8015 (TFH Diesel)	ITC (10/87, 1/88, 4/88, 8/88, 11/88)	IRPMS
17. 1st Phase Hydropunch	PCPT(H)-2 through PCPT (H)-5	38 to 118	SW8010 (VOCs) SW8020 (BTEX)	ITC (5/89)	ITC
18. 2nd Phase Hydropunch	H-10 through H-17	72 to 110	SW8010 (VOCs) SW8020 (BTEX)	ITC (1/90)	ITC
19. Cluster Wells (21 wells)	MWB-1, -4, -11, -13, -14 MWC-1, -2, -3, -4, -12, -13, -14 MWD-1, -3, -4, -10, -11, -12, -13, -14 MWE-3	66 to 89 93 to 110 127 to 181 204 to 224	SW8010 (VOCs) SW8015 (TFH Diesel) SW8020 (BTEX)	ITC (5/90 to 1/91)	ITC
20. MW- Series	See Above, No. 16		SW8010 (VOCs) SW8015 (TFH Diesel) SW8020 (BTEX)	ITC (2/91)	ITC
21. Quarterly Sampling	All wells listed in Nos. 15 and 16 (with exceptions advised by ITC)		SW8010 (VOCs) SW8015 (TFH Diesel) SW8020 (BTEX)	Radian (1/91, 5/91)	Radian

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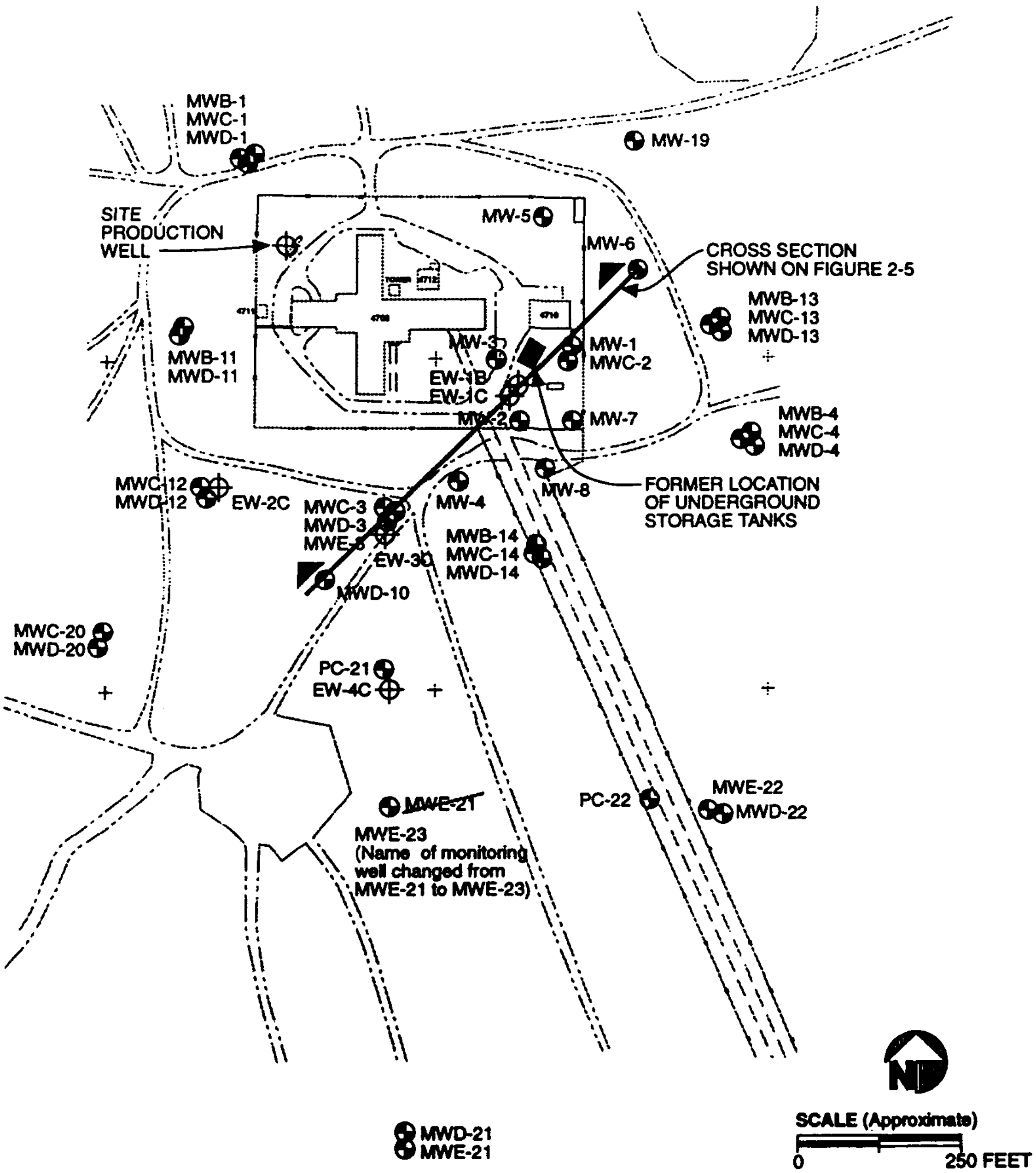
Table 2-1
Summary of Field Investigation Activities

Description Activity	Designation	Total Depth (feet bgs)	Analyses Performed	Contractor (Date Sampled)	Reference
22. Remedial Investigation Wells	PC-21, PC-22 MW-19, EW-1B MWC-20, EW-1C, EW-2C, EW-3C MWD-20, MWD-21, MWD-22 MWE-21, MWE-22	82 to 101 50 to 100 72 to 141 143 to 167 196 to 218	NA	Drilled by CH2M HILL (4/93 to 5/93)	CH2M HILL
23. Hydropunch	HP-2	72	SW8010 (VOCs)	CH2M HILL 6/93)	CH2M HILL
24. Quarterly Sampling	All Wells in Nos. 15, 18, and 21		SW8010 (VOCs) SW8015 (TFH Diesel) SW8020 (BTEX)	Radian (7/92, 10/92, 2/93, 4/93, 7/93, 10/93, 1/94, 4/94, 7/94)	CH2M HILL and Radian
SOIL GAS (Shallow Soil Gas Sampling, SVMWs, and Groundwater Wells Sampled for Soil Gas)					
25. 1st Phase Soil Gas Sampling	MC-1 through MC-67, PW-1, PW-2, PW-3 and NR-1 through NR-29 (94 samples)	10	Analyzed using PhotoVac tip or analyzed for TCE, PCE, VCL, and benzene using a mobile lab using nonstandard methods	ITC (4/89)	ITC
26. Shallow Soil Gas Sampling	SG-1 through SG-46 (67 samples)	5, 10, and 20	SW8021 (VOCs using Mobile GC) TO14 (VOCs using GCMS)	CH2M HILL (9/92)	CH2M HILL
27. Risk Assessement Samples	RA-01 through RA-04	5-20	SW8021 (VOCs using Mobile GC) TO14 (VOCs using GCMS)	CH2M HILL (9/92)	CH2M HILL
28. Sampling SVMWs and selected Groundwater Monitoring Wells and Piezometers	CH-1 through CH-6 MW-1, MW-3, MW-5, MW-7 P-1S, P-2M, P-3S, P-4S, P-5S	14-38 14-20	TO14 (VOCs using GCMS) D3416 ATM Gases	CH2M HILL (12/92)	CH2M HILL
29. Sampling Deep Piezometers	P-1D, P-3D, P-4D	40 to 60	TO14 (VOCs using GCMS)	CH2M HILL (8/93)	CH2M HILL

Notes:
ITC (ITC, Appendix E, 1992).
CH2M HILL (CH2M HILL RI/FS, 1993).
IRPIMS (Installation Restoration Program Information Management System, January 1991).
Radian (Radian, 1993).

G:\users\da\emr\davmain\TAB2-1.XLS



SITE MAP

Showing former underground storage tank location and monitoring well locations.

FIGURE 2-4
WELL LOCATION MAP
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

RDD1533_26

CH2MHILL

2.2.2 Removal and Remedial Action History

In 1988, the three underground storage tanks were drained and removed, and the area was covered with clean fill dirt. In 1993, a bioventing treatability study was started to address the residual diesel contamination in the soil in the area of the three underground storage tanks. The treatability study is scheduled to be completed by September 1994 with results available by February 1995. McClellan AFB plans on continuing operation and potential expansion of the bioventing system. An interim remedial action addressing groundwater contamination in the B and C zones is scheduled to begin in 1995.

2.3 Highlights of Community Participation

McClellan AFB has had a community relations program in place for the Davis Site since 1992, when a fact sheet describing the Remedial Investigation was distributed to community members, government officials, interest groups, and members of the media.

A Community Relations Plan (CRP), based on interviews conducted with community representatives, was developed in March 1993. The CRP describes the outreach activities to be conducted to respond to public information and involvement needs.

The Remedial Investigation/Feasibility Study (RI/FS) and Proposed Plan for the Groundwater Operable Unit were released to the public in May 1994. These two documents were made available to the public in both the Administrative Record and the information repositories maintained at McClellan AFB and the Yolo County (Davis Branch) Library. The notice of availability of these documents was published in the *Sacramento Bee*, the *California Aggie*, the *Davis Enterprise*, and the *Woodland Democrat* on May 5, 1994. The Proposed Plan was mailed to interested residents, government officials, representatives of interest and community groups, and members of the media.

A 30-day public comment period was held from May 6, 1994 through June 9, 1994. A public meeting was held on the evening of May 19, 1994, at Holmes Junior High School.

At this meeting, representatives from the Air Force, Cal-EPA/DTSC and RWQCB answered questions about contamination at the Davis Site and the remedial alternatives under consideration. A formal presentation about the proposed cleanup plan was made by the Air Force.

A Responsiveness Summary addressing oral and written comments received during the public comment period was developed and is attached to this IROD. This decision document presents the selected remedial action for the Davis Site and was chosen in accordance with ~~Resource Conservation and Recovery Act (RCRA), as amended by Hazardous and Solid Waste Amendments (HSWA)~~ the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund

Amendments and Reauthorization Act (SARA). The decision for the Davis Site is based on information contained in the Administrative Record.

McClellan AFB continues to hold Technical Review Committee Meetings semi-annually. The meetings are typically held in February and August to present the most current site information to interested parties and members of the Davis Site Technical Review Committee. The Technical Review Committee consists of members of the local governing bodies, regulatory agencies, and legislative officials.

2.4 Scope and Role of Response Action

This IROD addresses the planned interim action for remediation of the VOC-contaminated soil and containment of the B and C zone VOC-contaminated groundwater above MCLs at the Davis Site. For the vadose zone, the purpose of the interim action is to reduce VOC contamination concentrations in the soil to a level where they no longer act as a continuing source of groundwater contamination. According to RWQCB, soil gas concentrations of less than 500 ppbv for PCE are no longer considered a continuing source of groundwater contamination. ~~Soil gas concentrations for PCE in this range are approximately 100 ppbv~~ (Alex MacDonald, personal communication, September 1, 1994). The vadose zone response action will make use of existing and new SVE wells and a new granular activated-carbon treatment system to fulfill remediation goals.

The interim groundwater response action is designed to ~~capture and~~ contain known groundwater contamination above MCLs within the ~~A,~~ B, and C zones. ~~Cleanup goals have been established for the groundwater contamination at detection limits for VOCs (0.5 µg/l).~~ Groundwater occurring in the ~~A or~~ B zone poses the highest risk to human health or the environment. Therefore, the response action targets prevention of exposure to the zones of greatest risk and highest contamination.

The groundwater response action will make use of existing extraction and injection wells and a new UV oxidation treatment system to accomplish extraction, treatment, and end use of the contaminated groundwater. Currently, there is one groundwater extraction well located in the B zone and four groundwater extraction wells located in the C zone. It is estimated that these wells will be capable of extracting a sufficient flow rate to maintain containment of contamina~~nt~~tion. ~~capture.~~

The current response action includes extracting and treating contaminated groundwater from the ~~A,~~ B, and C zones ~~(Target Volume 1)~~ and extracting and treating contaminated soil vapor from the vadose zone. Additional future response actions could involve installing additional groundwater extraction wells and pumping contaminated groundwater from the D and E zones. If additional pumping is initiated, it is likely that the treatment and end-use systems will be scaled to accommodate the increased flow and remain consistent with the interim response action.

Monitoring of groundwater levels and water quality for all zones beneath the site is planned as part of this interim action. This monitoring and data gap analysis will be used to determine the effectiveness of the interim action. A monitoring plan will be presented in *the groundwater extraction workplan for the B and C zone remedy.*

2.5 Summary of Site Characteristics

This section is a summary of the following source area information:

- Hydrogeologic Zones
- Sources of Contamination
- Contaminants of Concern
- Extent of Contamination

2.5.1 Hydrogeologic Zones

Five subsurface zones were identified during past investigations at the Davis Site (ITC, 1992). The five zones include the A (vadose zone), B, C, D, and E zones. These zones are made up of coarse-grained and fine-grained materials. The five zones extend to a depth of approximately 245 feet below the site. A cross-section schematic representation of the hydrogeologic zones is shown in Figure 2-5. Descriptions of each zone follow below.

2.5.1.1 A Zone–Vadose Zone

Clays comprise most of the vadose zone. The only extensive permeable deposit is a sand deposit typically 10 feet thick found between 20 and 40 feet bgs. It is a fining upward sequence with a coarse sand at the bottom grading upward to a fine sand and silty sand at the top. This deposit is found consistently beneath the fenced compound and east of the fenced compound area, but not west of the fenced compound.

The thickness of the vadose or unsaturated zone ranges from 25 to 70 feet bgs from winter to summer as the water level drops because of regional agricultural pumping. Because the extent of the vadose zone is changing daily as a result of water level fluctuations, the vadose zone within this document was considered to extend from the ground surface to 40 feet bgs. In a typical year, this zone is unsaturated a majority of the time. The zone between 40 and 70 feet bgs is considered a seasonal vadose zone because it is unsaturated less than half the year.

This 40- to 70-foot zone comprises fine-grained materials of relatively low permeability and low organic carbon. Contaminants in the fine-grained ~~this~~ region between 40 and 70 feet bgs are mobilized each winter as water levels rise, saturating the available pore spaces and dissolving residual contaminants sorbed to the soil. The dissolved contaminants may then flow both laterally and vertically with the groundwater. The predominantly clay soils have a high specific retention of water whereby most of the moisture in the pore spaces is

retained after the water table drops. This reduces the available storage within the clays and allows for a large increase in water levels under relatively small amounts of recharge.

2.5.1.2 B Zone

The B zone extends from 65 feet bgs to approximately 95 feet bgs. In general, permeable deposits are thickest in the area of Extraction Well (EW)-1B with about 25 feet of well-sorted gravel and sand intermixed with silty sand in this vicinity. The permeable deposits thin and pinch out within 100 feet south and west of EW-1B and within 200 to 300 feet north and east from EW-1B. The permeable materials are bounded above and below by sandy and silty clays. Discontinuous lenses of permeable material are interspersed throughout the subsurface at other locations away from the fenced compound area (near Monitoring Wells MWB-1, MWB-11, and MWB-14) but little to no contamination has been detected at these locations.

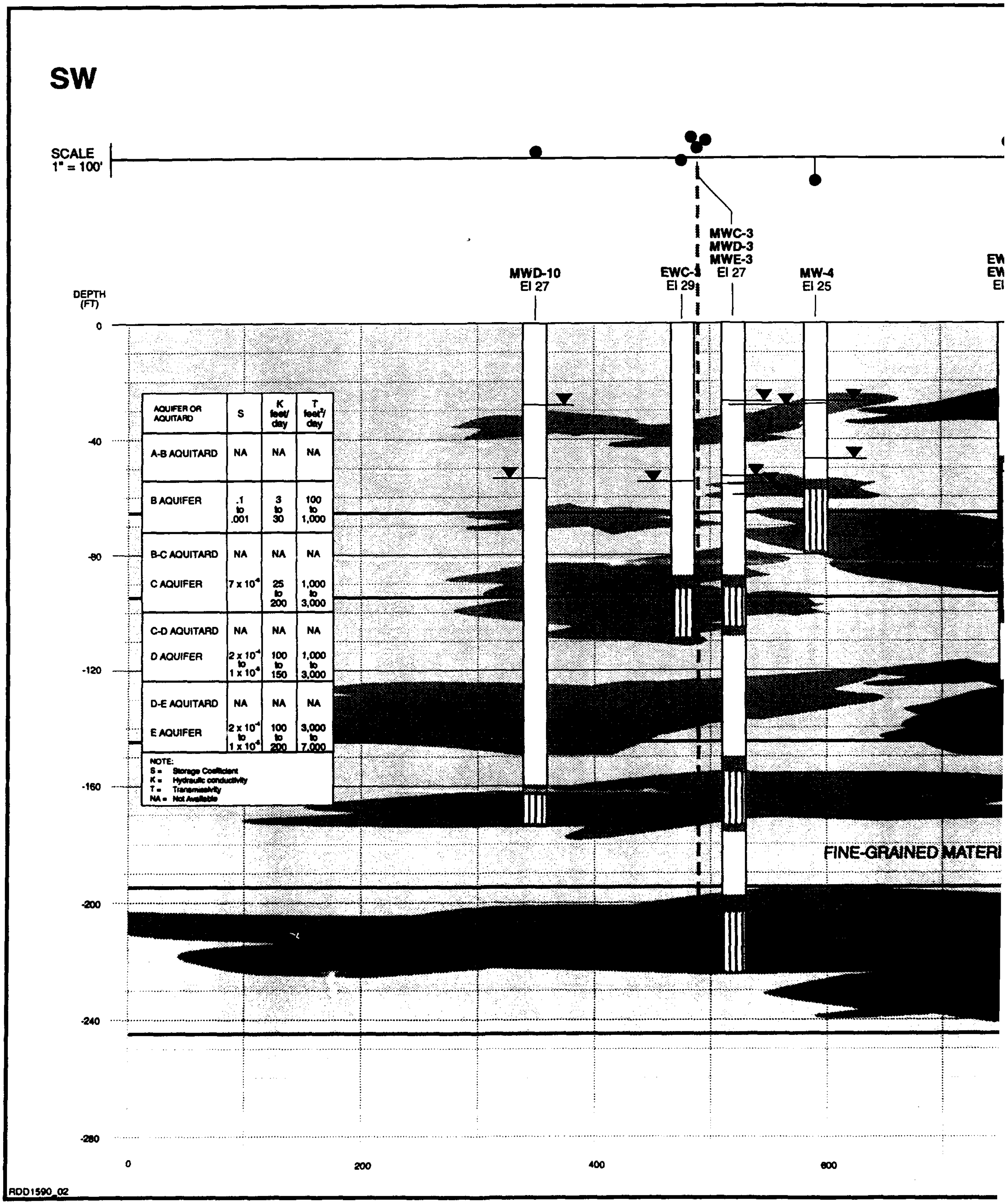
2.5.1.3 C Zone

The base of the C zone is located at approximately 145 feet bgs. In all likelihood, the base of the B zone and the top of the C zone are one depositional sequence. Water levels in the two zones are nearly equal, and horizontal gradients are very similar.

Extraction Well EW-1C and Monitoring Well ~~MWD-2~~ MWC-2 are the only wells completed in the C zone within the fenced compound area. The coarse-grained materials within the C zone become more permeable with depth according to well development testing. Most of the permeable units within the C zone above 115 feet bgs are composed of silty sand. The units below 120 feet thicken and are typically composed of sand and gravel with sand. The permeable unit between approximately 120 feet and 145 feet bgs, bounded by Monitoring Well ~~MWD-2~~ MWC-2 on the northeast and Monitoring Well MWD-10 on the southwest, appears to be continuous within this range. This zone has the potential to be a conduit for downward contaminant movement beneath the site by linking the C and D zones near Well Cluster MW3.

2.5.1.4 D Zone

The D zone extends from approximately 145 to 195 feet bgs. With the exception of the site production well, there are no wells screened within the D zone in the fenced compound area. Most of the permeable material is composed of well-graded gravel and gravel and sand mixtures. A clay matrix separates the permeable units within this zone. The zone appears to be thickest along the entrance road to the compound at depths between approximately 145 to 175 feet. Monitoring Well MWD-13 appears to be screened across the interface of the D and E zones. Monitoring Well MWD-13 water levels have been lower than most D zone wells in the past. Near Well Cluster MW3, the lower C zone and upper D zone are separated by less than 10 feet of silt and fine sand. ~~This~~ Therefore, the area around Well Cluster MW3 has the potential for vertical movement of contamination from above.



AQUIFER OR AQUITARD	S	K feet/day	T feet²/day
A-B AQUITARD	NA	NA	NA
B AQUIFER	.1 to .001	3 to 30	100 to 1,000
B-C AQUITARD	NA	NA	NA
C AQUIFER	7 x 10^{-4}	25 to 200	1,000 to 3,000
C-D AQUITARD	NA	NA	NA
D AQUIFER	2 x 10^{-4} to 1 x 10^{-6}	100 to 150	1,000 to 3,000
D-E AQUITARD	NA	NA	NA
E AQUIFER	2 x 10^{-4} to 1 x 10^{-6}	100 to 200	3,000 to 7,000

NOTE:
S = Storage Coefficient
K = Hydraulic conductivity
T = Transmissivity
NA = Not Available

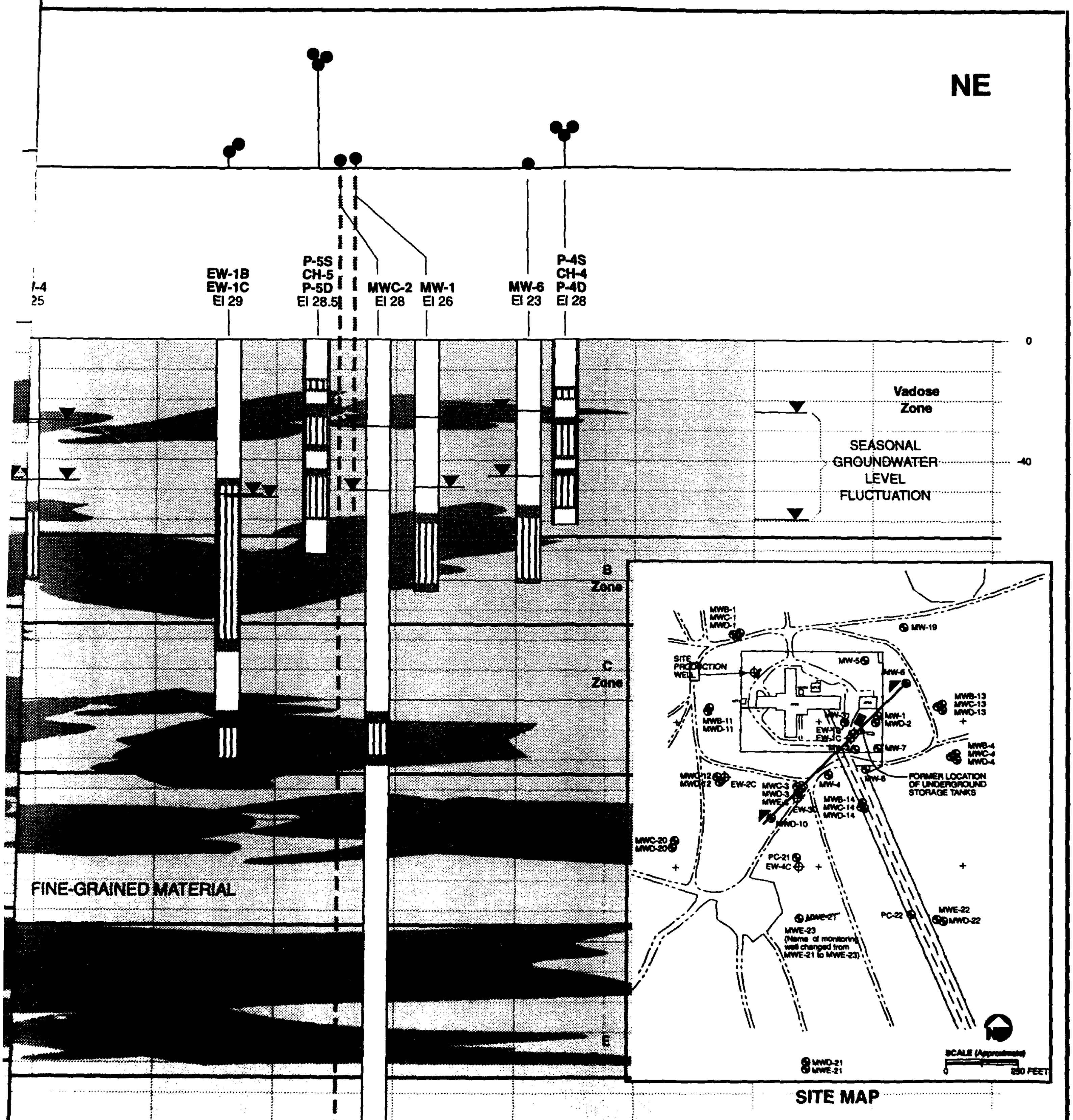


FIGURE 2-5
GENERALIZED SITE CROSS SECTION FROM MWD-10 TO CH-4
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

CH2MHILL

The site production well and several offsite agricultural production wells are screened within ~~this~~ the D zone. Therefore, water levels ~~measurements~~ fluctuate rapidly in response to onsite and offsite pumping. No evidence of this zone was found during drilling of the test hole approximately 2,600 feet north of Extraction Well EW-1B.

2.5.1.5 E Zone

The E zone extends from approximately 195 feet to 245 feet bgs beneath the site. Currently, the following wells are screened within this zone: Monitoring Wells MWE-3, MWE-21, MWE-22, MWE-23, MWE-24, and Injection Wells IW-1 and IW-2. Lean and fat clays separate the layers of poorly sorted gravel and sand within this zone. The permeable unit appears to be about 30 feet thick across the site. This zone is considered a regional aquifer, and most offsite wells in the vicinity of the site are screened across this zone.

2.5.2 Hydraulic Properties

Hydraulic properties of each zone have been estimated from aquifer testing and testing during well development performed at the site (CH2M HILL, 1992; CH2M HILL 1993). Transmissivities generally increase with depth at the site. Because of the heterogenous nature of the subsurface, hydraulic properties vary significantly within each zone. Table 2-2 gives a range of hydraulic properties estimated for each zone.

Table 2-2
Estimated Hydraulic Properties

Aquifer	Storage Coefficient	Hydraulic Conductivity (ft/day)	Transmissivity (ft^2/day)
B	0.1 to 0.001	3 to 30	100 to 1,000
C	7×10^{-6}	25 to 200	1,000 to 3,000
D	2×10^{-4} to 1×10^{-5}	100 to 150	1,000 to 3,000
E	2×10^{-4} to 1×10^{-5}[a]	100 to 200	3,000 to 7,000

[a]Estimated based on D aquifer results.

2.5.3 Groundwater Levels and Flow Directions

Groundwater levels and flow directions vary greatly beneath the site. A major source of uncertainty remains with regard to groundwater levels and flow directions in the D and E aquifers. Onsite pumping of the site production well and offsite pumping from agricultural wells are operations that influence and dictate groundwater levels and flow directions beneath the site. The pumping schedules cause variability in groundwater flow directions because single agricultural wells can dominate the apparent groundwater flow direction when the well is pumping.

Because of the effects of agricultural pumping near the site, groundwater flow directions and flow rates within aquifers beneath the site ~~are variable~~ change seasonally. Groundwater flows to~~Z~~ the south-southeast with a gradient of approximately 0.005 ft/ft in the B and C zones from May to November in response to the regional eastward gradient and the persistent groundwater pumping depression southwest of the site near the City of Dixon. Groundwater flows north-northwest in the winter in the B and C zones with a gradient of approximately 0.0008 ft/ft. The D zone gradient appears nearly flat most of the year. ~~However, it is likely that regional pumping causes D Zone groundwater to flow toward the production wells to the east and south which are nearest the site.~~ The horizontal gradients for the B, C, and D zones for the period from July 1992 through July 1993 are shown in Figures 2-6a through 2-6c. It is likely that agricultural pumping south and east of the site influences D zone groundwater flow directions.

Figure 2-~~6~~ 7 shows vertical gradients between the C and D zones, C and E zones, and D and E zones based on measurements at Well Cluster MW3 south of the compound. Groundwater levels for the B zone are nearly identical with those from the C zone. Therefore, vertical gradients between the B zone and lower zones are the same as those shown in Figure 2-7 for the C zone and lower zones. Downward gradients exist from May to October because of agricultural pumping from deep zones. Gradients from the D to E zones are the largest at 0.22 ft/ft downward during summertime pumping conditions because the E zone is pumped heavily for agriculture. These downward gradients cause flow from shallow zones to deeper zones at the site. Slight upward gradients exist for all zones from November through March preventing downward contaminant movement. The vertical gradient trends are generally consistent across the site.

2.5.4 Sources of Contamination

No single source of soil and groundwater contamination has been identified at the Davis Site. It is suspected that past disposal practices of spent solvents has contributed to the existing soil and groundwater contamination. On the basis of modeling performed for the RI/FS, the existing soil contamination will continue to be a source of groundwater contamination for over 200 years if not corrected.

The source of petroleum hydrocarbon contamination was determined to be three underground storage tanks and associated piping. These tanks were removed in 1988. Residual diesel contamination exists at the site; therefore, a pilot-scale bioventing study has been undertaken by McClellan AFB.

2.5.5 Contaminants of Concern

Table 2-3 summarizes the contaminants of concern (COCs) for the Davis Site. This list was ~~2.5.6~~developed from the risk assessment analysis, as summarized in the risk assessment report for the site (CH2M HILL, 1993a). As shown in the table, the COCs are subdivided according to whether they exist in the vadose zone or in the groundwater, or in both. The following criteria were used to develop the COCs list:

NOTE: The gradient on 4/26/93 was flat and is not presented in the figure.

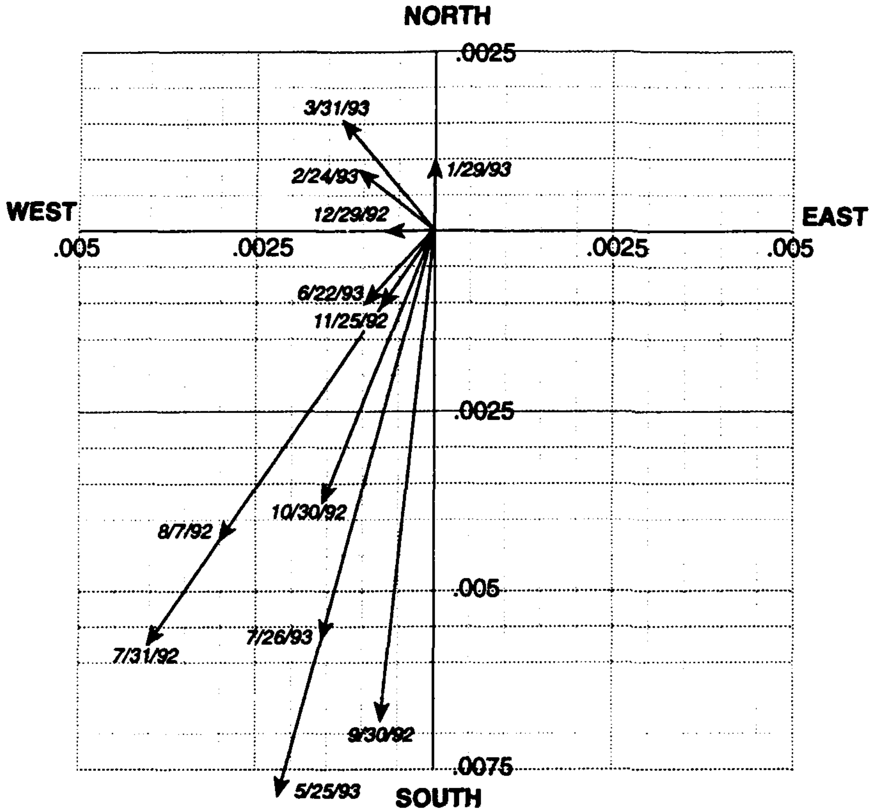


FIGURE 2-6a
B AQUIFER HORIZONTAL GRADIENTS JULY 1992 THROUGH JULY 1993

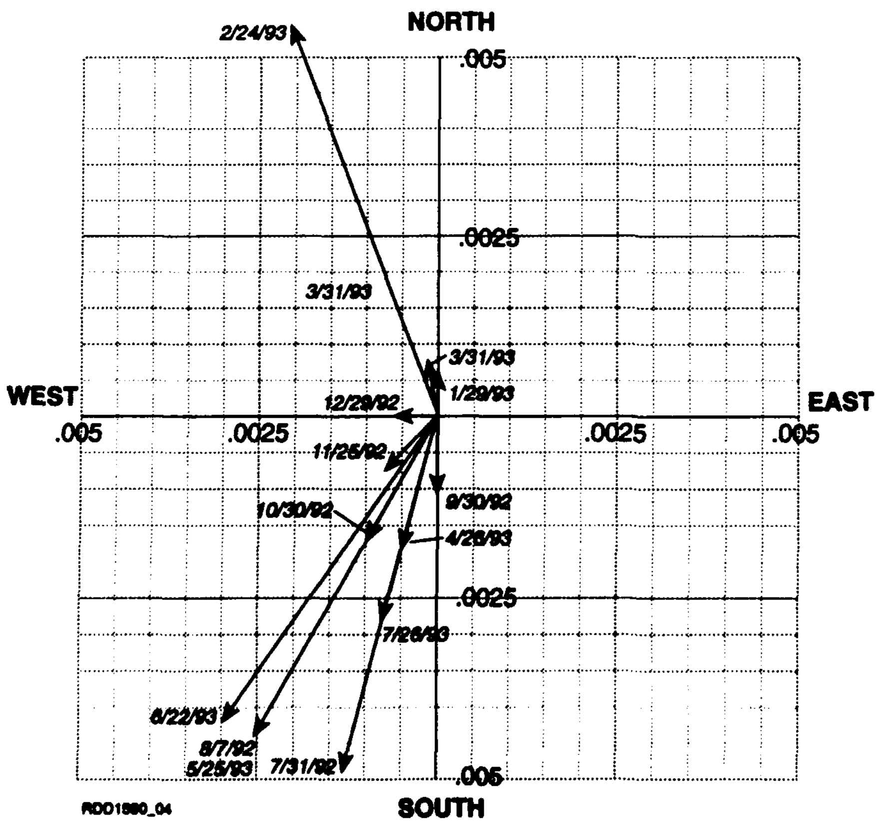


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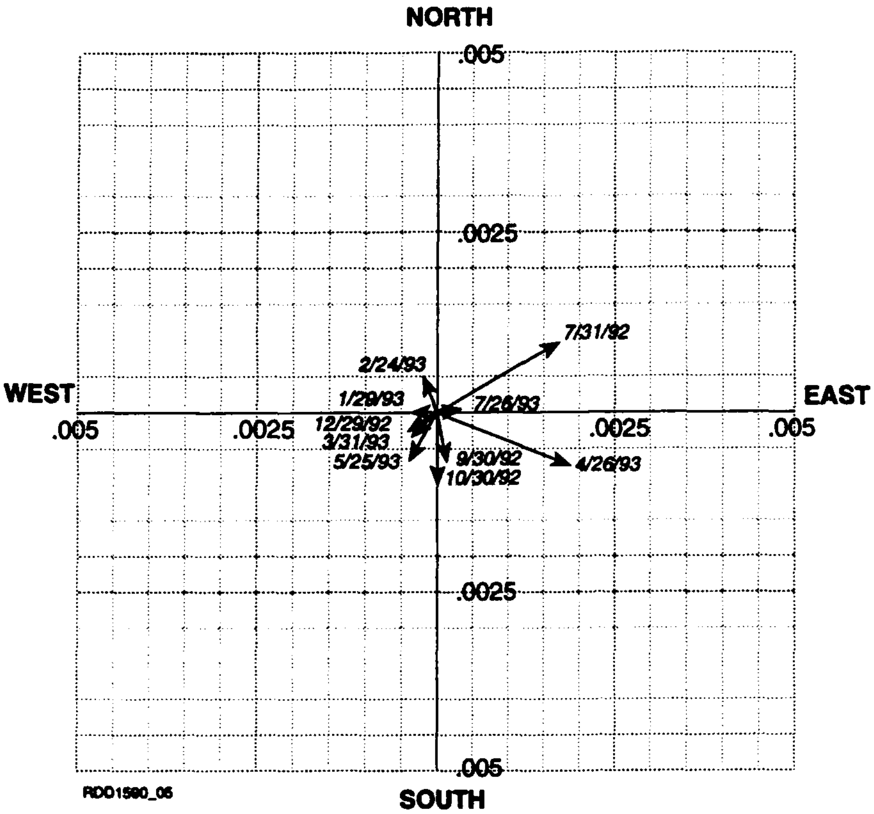
FIGURE 2-6b
C AQUIFER HORIZONTAL GRADIENTS JULY 1992 THROUGH JULY 1993



NOTE: The gradient on 8/7/92, 11/25/92, and 6/22/93 was flat and are not presented in the figure.

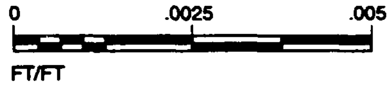


FIGURE 2-6c
D AQUIFER HORIZONTAL GRADIENTS JULY 1992 THROUGH JULY 1993

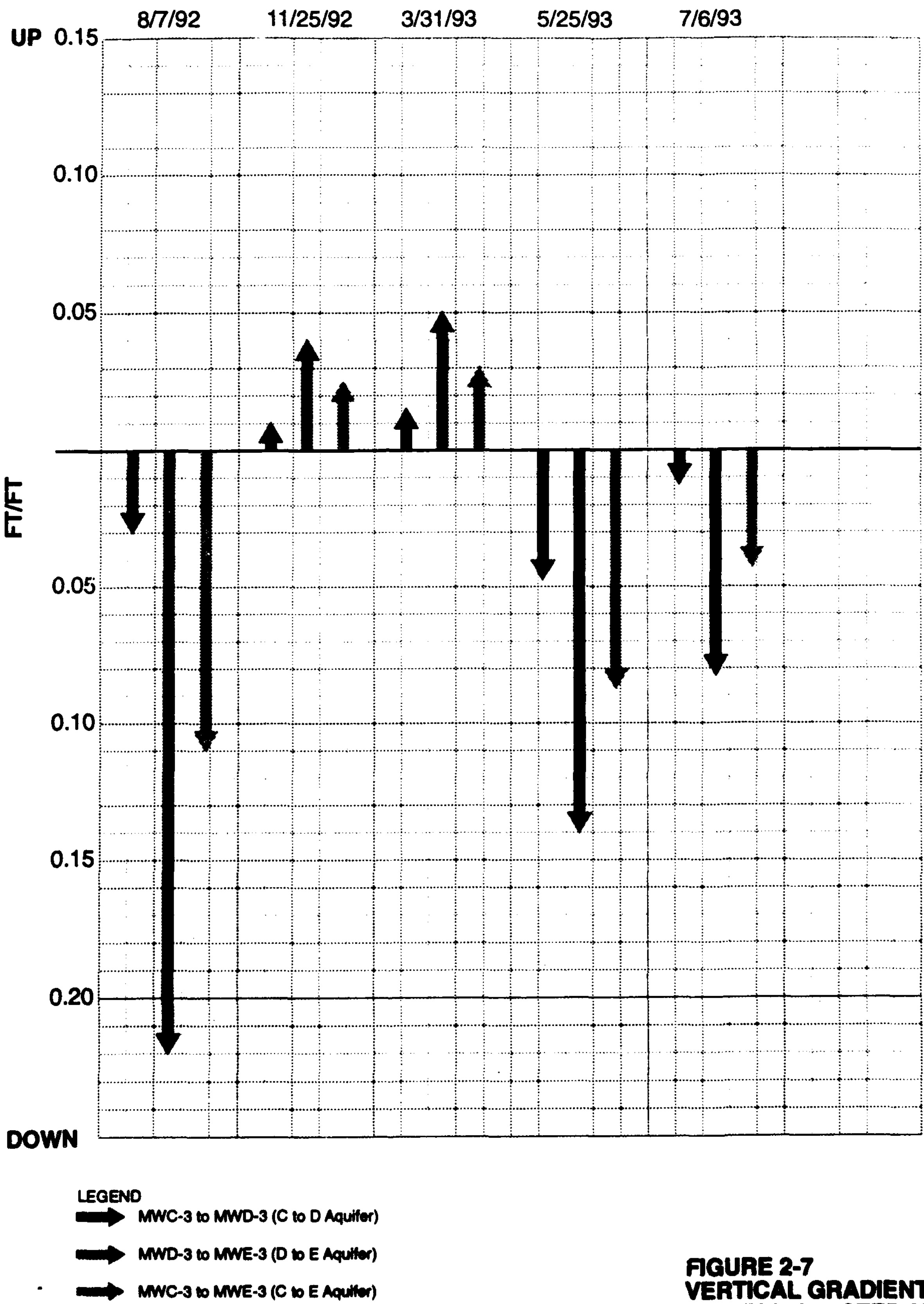


FIGURE 2-7
VERTICAL GRADIENTS AT WELL CLUSTER MW3
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

RDD1533_02

CH2M HILL

Table 2-3 Contaminants of Concern			
Compound	**Contaminant of Concern in Vadose Zone**	**Contaminant of Concern in Groundwater**	**Comments**
1,1-Dichloroethane	x	x	Exceeds drinking water standards in groundwater.
1,1-Dichloroethene	x	x	Exceeds drinking water standards in groundwater.
1,1,1-Trichloroethane	x	x	Contributes greater than 1 percent of total site risk.
1,1,2-Trichloro-1,2,2-trifluoro-ethane		x	Detected in site production well above drinking water standards.
1,4-Dichlorobenzene		x	Detected in site production well above drinking water standards.
2-methylnaphthalene	x		Possible constituent of diesel-range petroleum hydrocarbons in soil. It has the potential to migrate to groundwater.
Acetone		x	Detected in site production well above drinking water standards.
Benzene	x	x	Exceeds drinking water standards in groundwater. Possible constituent of diesel-range petroleum hydrocarbons in soil.
Bis(2-ethylhexyl)phthalate	x		Source unknown. Typical laboratory contaminant. If it exists, it has the potential to migrate to groundwater.
Bromodichloromethane		x	Exceeds drinking water standards in site production well. Not typically detected in monitoring wells.
Bromoform		x	Exceeds drinking water standards in site production well. Not typically detected in monitoring wells.
Butylbenzylphthalate	x		Source unknown. Typical laboratory contaminant. If it exists, it has the potential to migrate to groundwater.
Chlorodibromomethane		x	Exceeds drinking water standards in site production well. Not typically detected in monitoring wells.
Chloroform		x	Exceeds drinking water standards in site production well. Not typically detected in monitoring wells.

Table 2-3 Contaminants of Concern			
Compound	**Contaminant of Concern in Vadose Zone**	**Contaminant of Concern in Groundwater**	**Comments**
cis-1,2-dichloroethene		x	Exceeds drinking water standards in groundwater.
Di-n-butylphthalate	x		Source unknown. Typical laboratory contaminant. If it exists, it has the potential to migrate to groundwater.
Dibenzofuran	x		Possible constituent of diesel-range petroleum hydrocarbons in soil. It has the potential to migrate to groundwater.
Ethylbenzene	x		Possible constituent of diesel-range petroleum hydrocarbons in soil. It has the potential to migrate to groundwater.
Ethylene dibromide (EDB)		x	Detected in site production well above drinking water standards. Occurrence likely to be associated with agricultural pesticide use and not related to site activities.
Fluorene	x		Possible constituent of diesel-range petroleum hydrocarbons in soil. It has the potential to migrate to groundwater.
m- and p-xylenes	x	x	Possible constituent of diesel-range petroleum hydrocarbons in soil. It has the potential to migrate to groundwater.
Methyl isobutyl ketone		x	Detected in site production well above drinking water standards.
Methyl ethyl ketone		x	Detected in site production well above drinking water standards.
Naphthalene	x		Possible constituent of diesel-range petroleum hydrocarbons in soil. It has the potential to migrate to groundwater.
o-xylene	x	x	Possible constituent of diesel-range petroleum hydrocarbons in soil. It has potential to migrate to groundwater.

Table 2-3 Contaminants of Concern			
Compound	**Contaminant of Concern in Vadose Zone**	**Contaminant of Concern in Groundwater**	**Comments**
Petroleum hydrocarbons	x	x	Possible constituent of diesel-range petroleum hydrocarbons in soil. Petroleum hydrocarbon detected in groundwater above drinking water standards near underground storage tank site.
Phenanthrene	x		Possible constituent of diesel-range petroleum hydrocarbons in soil. It has the potential to migrate to groundwater.
Pyrene	x		Possible constituent of diesel-range petroleum hydrocarbons in soil. It has the potential to migrate to groundwater.
Tetrachloroethene (PCE)	x	x	Exceeds drinking water standards in groundwater. Contaminant in soil is a potential source for continuing contaminant release to groundwater.
Toluene	x	x	Possible constituent of diesel-range petroleum hydrocarbons in soil. It has the potential to migrate to groundwater.
trans-1,2-dichloroethene		x	Exceeds drinking water standards in groundwater.
Trichloroethene (TCE)	x	x	Exceeds drinking water standards in groundwater.
Trichlorofluoromethane		x	Detected in site production well above drinking water standards.
Vinyl chloride	x	x	Exceeds drinking water standards in groundwater.

1. A contaminant was considered a COC if it contributed to 1 percent or more of the total site risk according to the risk assessment evaluation.

2. Contaminants in the groundwater were considered COCs if their concentrations exceeded drinking water standards.

3. Contaminants in the vadose zone were considered COCs if they had the potential to contaminate groundwater in the future via downward migration.

Some of the COCs listed in Table 2-3 are probably not derived from Davis Site operations and their discharge. For example, ethylene dibromide (EDB) is a common soil fumigant used for agricultural purposes and is likely derived from agricultural activity near the site. In addition, the trihalomethane contaminants (THMs) are probably created after the water from the production well is subject to chlorination, and are not frequently detected in situ in the groundwater. However, all identified COCs are listed here because they all have the potential to impact human health. A subset of COCs was generated for the vadose zone and groundwater. This subset, the SCOCs, is presented for each medium in Tables 2-4 and 2-5. In Section 2.6.3, contaminants of potential concern are identified. (The contaminants of potential concern are those listed as COCs in Table 2-3.) The SCOCs for each groundwater zone are presented in Table 2-6 along with the range of detected contamination.

2.5.6 Extent of Contamination

Contamination in the vadose zone is less widespread than the contamination in the groundwater. The vadose zone contamination extends over an area of about 4 acres, but the groundwater contamination spreads out over an area of about 30 acres. All of the known contamination is near the center and within the boundaries of the site. The known groundwater contamination is over 500 feet from the nearest property boundary. The extent of contamination within each zone is shown in Figure 2-~~7~~8 For the B, C, and D zones, both the MCL extent of contamination and the non-detect extent of contamination are shown. The target volume for contamination in the B and C zones is the MCL-based target volume.

It is estimated that approximately 700 pounds of contamination remain beneath the Davis Site. Approximately 85 percent (600 pounds) of the VOC contamination occurs within the A, B, and C zones, as shown in Figure 2-~~8~~ 9. As the VOC contamination moves downward from the vadose zone into the deeper zones, it tends to spread out and decrease in concentration.

Table 2-4 Summary Statistics for Vadose Zone SCOCs						
Compound	**Number of Detects/ Samples**	**Frequency of Detects**	**Range of Detects (µg/l)**	**Mean**	**Standard Deviation**	**Percent of Total Mass**
Tetrachloroethylene (PCE)	85/92	0.92	0.020 to 541.20	44.87	99.43	90.1
Trichloroethylene (TCE)	52/92	0.57	0.010 to 50.35	3.96	8.94	4.2
1,1-Dichloroethylene (1,1-DCE)	32/92	0.35	0.030 to 10.14	1.86	2.69	0.3
Benzene	36/92	0.39	0.007 to 1.12	0.11	0.19	0.1
Vinyl chloride	1/92	0.01	<0.0 to 0.0030	0.00	--	2.0
Toluene	59/92	0.64	0.007 to 25.90	1.11	4.51	0.7
m-, p-Xylene[a]	43/92	0.47	0.004 to 16.30	0.50	2.47	2.6
o-Xylene[b]	25/92	0.27	0.013 to 17.50	0.83	3.47	0.0

[a]Sum of isomers.
[b]1,2-Dimethylbenzene.

Table 2-5 Summary Statistics for Groundwater SCOCs					
Compound	**Number of Detects/ Samples**	**Frequency of Detects**	**Range of Detects (µg/l)**	**Mean**	**Standard Deviation**
PCE	151/312	0.48	0.12 to 1,400	95.97	214.46
TCE	214/295	0.73	0.27 to 3,000	104.47	278.10
1,1-DCE	113/330	0.34	<0.0 to 390	26.36	44.21
Benzene	24/310	0.08	<0.0 to 11	1.71	2.56
Vinyl Chloride	30/340	0.09	<0.0 to 410	111.43	129.84
1,1-DCA	40/340	0.12	<0.0 to 38	5.06	8.56
cis-1,2-DCE	64/223	0.29	0.41 to 870	14.53	74.31
trans-1,2-DCE	35/120	0.29	<0.0 to 3,400	409.45	922.92

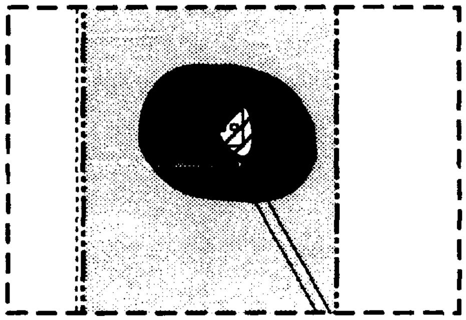
Table 2-6
Range of Contaminant Concentrations Found in Groundwater
July 1992 through July 1993

Parameter Name	Minimum Detected Value (µg/l)	Maximum Detected Value (µg/l)	Well Name	Date of Maximum Detect
B Zone				
1,1-Dichloroethane	1.7	4.66	MW-7	07/09/93
1,1-Dichloroethylene	1	114	MW-3	07/09/93
Benzene	0.3	7.48	MW-2	07/09/93
cis-1,2-Dichloroethylene	.339	410	MW-3	02/01/93
Tetrachloroethylene	.120	464	MW-5	07/09/93
trans-1,2-Dichloroethylene	1.3	1.7	MWB-14	07/30/92
Trichloroethylene	.222	570	MW-3	08/03/92
Vinyl chloride	2.3	86.3	MW-1	07/09/93
C Zone				
1,1-Dichloroethane	4.68	802	MWC-3	07/07/93
1,1-Dichloroethylene	ND	ND	–	–
Benzene	ND	ND	–	–
cis-1,2-Dichloroethylene	.39	1.6	MWC-14	08/03/92
Tetrachloroethylene	.25	57	MWC-3	10/30/92
trans-1,2-Dichloroethylene	ND	ND	–	–
Trichloroethylene	.32	34	MWC-3	04/28/93
Vinyl chloride	ND	ND	–	–

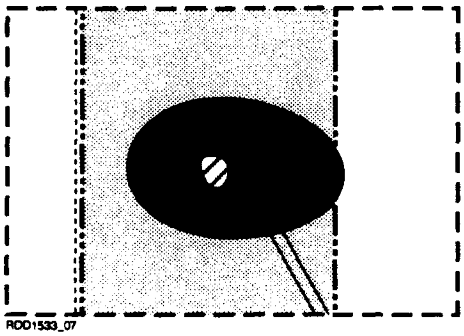
Table 2-6
Range of Contaminant Concentrations Found in Groundwater
July 1992 through July 1993

Parameter Name	Minimum Detected Value (µg/l)	Maximum Detected Value (µg/l)	Well Name	Date of Maximum Detect
Zone D				
1,1-Dichloroethane	ND	ND	–	–
1,1-Dichloroethene	.85	35.4	MWD-10	07/08/93
Benzene	ND	ND	–	–
cis-1,2-Dichloroethylene	.32	2.74	MWD-3	07/07/93
Tetrachloroethylene	.166	67.6	MWD-3	07/07/93
trans-1,2-Dichloroethylene	ND	ND	–	–
Trichloroethylene	.233	46.7	MWD-3	07/07/93
Vinyl Chloride	ND	ND	–	–
Zone E				
1,1-Dichloroethane	ND	ND		
1,1-Dichloroethene	.37	6.12	MWE-12	07/14/93
Benzene	ND	ND	–	–
cis-1,2-Dichloroethylene	.37	.37	MWE-21	07/14/93
Tetrachloroethylene	.195	1.19	MWE-3	07/06/93
trans-1,2-Dichloroethylene	ND	ND	–	–
Trichloroethyle				

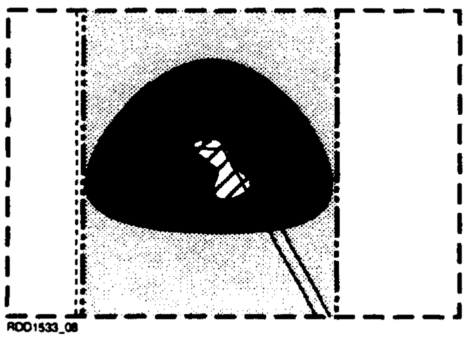
RDD1001403F.WP5



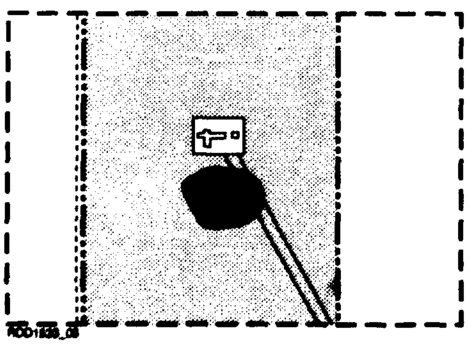
CONTAMINATION
IN THE B ZONE



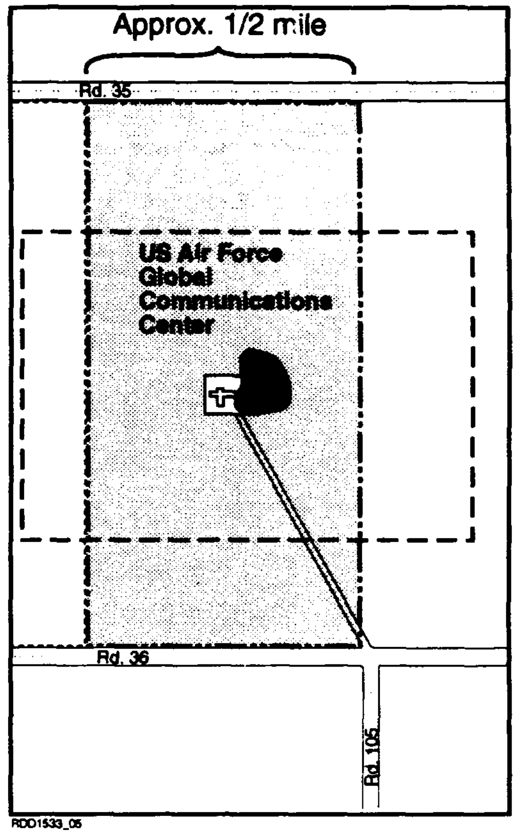
CONTAMINATION
IN THE C ZONE



CONTAMINATION
IN THE D ZONE

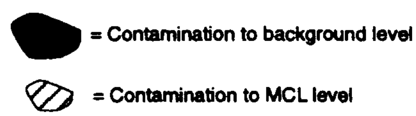


CONTAMINATION
IN THE E ZONE



CONTAMINATION
IN THE A ZONE

LEGEND



NOT TO SCALE, TYPICAL

FIGURE 2-8
EXTENT OF SOIL AND GROUNDWATER CONTAMINATION IN ZONES A THROUGH E
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

RDD1533_11

CH2MHILL

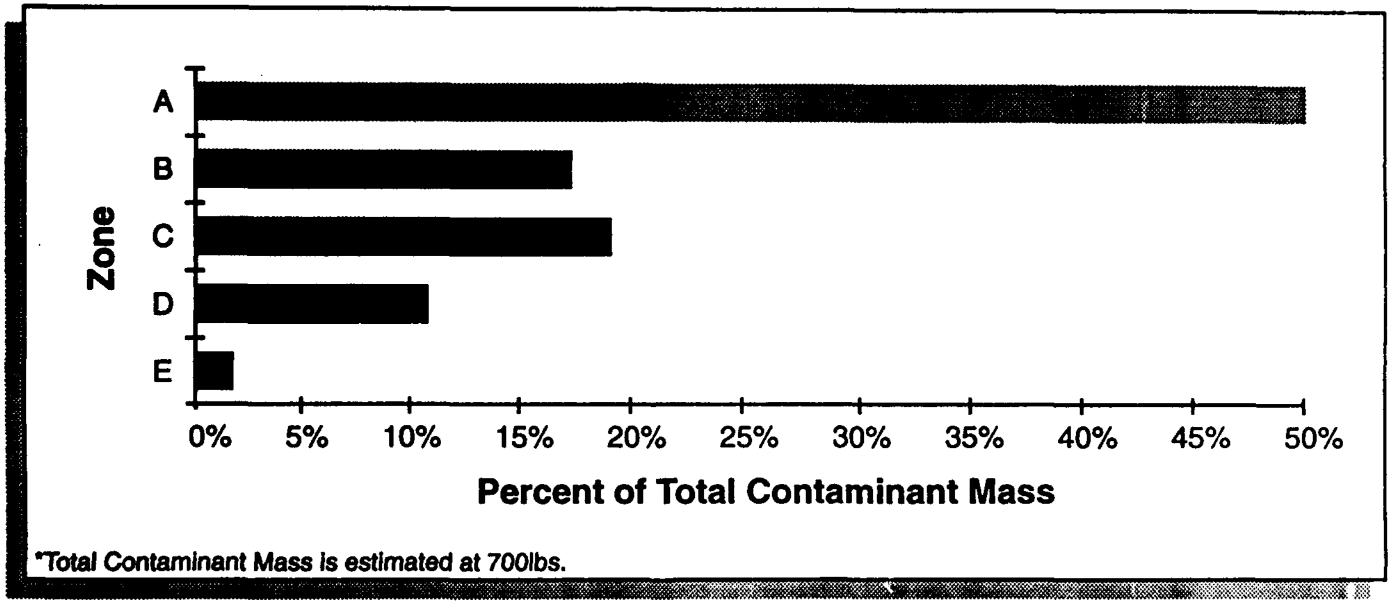


FIGURE 2-9
CONTAMINATION DISTRIBUTION BY ZONE
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

RDD1533_10

CH2M HILL

2.6 Summary of Site Risks

A risk assessment was prepared that addressed both the potential human health and ecological risks associated with contaminants detected at the Davis site. To complete the risk assessment, information developed through the remedial investigations conducted at the site was used to do the following:

- Identify contaminants of potential concern at the site
- Identify potential exposure pathways from the contaminants of potential concern to human and ecological receptors
- Estimate contaminant concentrations in soil and groundwater that receptors could become exposed to through the identified potential exposure pathways
- Estimate contaminant intake rates through the identified potential exposure pathways
- Characterize potential risks to humans and wildlife associated with estimated intake rates

2.6.1 Focus on Risks Addressed by Interim Action

The risk assessment prepared for the Davis Site provided an evaluation of the range of risks associated with contaminants detected at the site. One of the most important roles of the risk assessment was to identify the risks to be addressed by the interim action. The following results from the risk assessment indicate whether additional action is required:

- Direct contact exposures (soil ingestion and skin contact with soil) to petroleum hydrocarbon contaminants in soil do not represent ~~a~~ significant human health or ecological health risks, and require no further action.
- Emissions of VOCs in soil gas to air and subsequent inhalation exposures do not represent a significant health risk and require no further action.
- Further action is warranted to evaluate the potential exposures and health risks associated with contaminants detected in groundwater from the site production well.
- VOCs in soil gas potentially represent a significant long-term threat to the groundwater quality beneath the Davis Site and require further action.

- VOCs in groundwater potentially represent a significant health risk, should that groundwater be used for residential or domestic purposes, and require further action. Concentrations of VOCs in groundwater also exceed their respective state and federal drinking water standards.

2.6.2 Rationale for Limited Scope of Interim Action

The results from the risk assessment indicate that VOCs detected in B and C zone groundwater should be addressed by the interim action. The interim action should also address VOCs detected in soil gas to the extent that these contaminants represent an ongoing source of contamination to groundwater. As described in the RI/FS report, four water-bearing units that are contaminated have been identified beneath the Davis Site. Starting with the shallowest unit, these have been named the B, C, D, and E zones, respectively.

Most of the groundwater contamination has been detected in the B and C zones. A significant amount of additional effort would be required to extract the residual contaminants from the D and E zones, and the proposed scope of the interim action is to address the largest portion of the contaminant mass detected in the B and C zones. The interim action is also designed to eliminate contaminant flux from the B and C zones to the deeper zones. The interim action is also necessary to prevent further environmental degradation and achieve significant risk reduction by pumping the B and C zones, which are the most contaminated. This interim action could become the final action if groundwater extraction in the B and C zones effectively controls contaminant movement in the D and E zones.

Estimated health risks associated with groundwater contaminants were based on contaminant concentrations detected in the B and C aquifers. It is anticipated that ~~R~~residual contaminants would remain in groundwater with an interim action that addresses the B and C zones. However, it is not known what level of contamination would remain in the D and E zones. Therefore, a summary of the worst-case contaminant concentrations that would remain in the D and E zones is presented in Table 2-6. It is possible that these contaminant concentrations would decrease over time because of natural attenuation or remedial action in the upper zones.

Estimated health risks potentially associated with these contaminant concentrations are presented in Tables 2-~~7~~ 8 and 2-~~8~~ 9. The increased lifetime cancer risks (ILCRs) associated with potential exposure to these contaminants in groundwater are presented in Table 2-~~7~~ 8. The noncancer hazard indexes (HI) associated with potential exposure to these contaminants in groundwater are presented in Table 2-~~8~~ 9. These risk estimates, which represent the possible residual risks associated with the interim action, are discussed further in Section 2.10.

Table 2-~~6~~ 7
VOCs in D and E Zone Groundwater

Well	Date Sampled	Concentration in Groundwater (µg/l)			
		1,1-DCE	1,2-DCE	PCE	TCE
MWD-3	2/93	ND	1.3	26	29
MWD-3	7/93	26	2.7	51	47
MWE-3	2/93	--	--	--	0.31
MWE-3	7/93	--	--	--	ND
MWE-21	6/93 (170 ft)	6.3	10.2	ND	36.9
MWE-21	7/93	--	--	--	3
MWD-14	2/93	--	0.68	0.79	15
MWD-14	7/93	--	ND	0.17	2.5
MWE-22A	6/93	--	1.4	--	11.7
MWE-22	7/93	--	--	0.51	1.1
MWD-11	2/93	--	--	--	0.47
MWD-11	7/93	--	--	--	0.23
MWD-13	2/93	--	--	--	1.2
MWD-13	7/93	--	--	--	0.52
MWD-12	2/93	ND	--	5.9	13
MWD-12	7/93	22	--	6.5	16
MWD-4	2/93	--	--	--	0.28
MWD-4	7/93	--	--	--	4.7

-- = Not reported.
ND = Not detected.

Table 2-~~7~~ 8
Increased Lifetime Cancer Risks Associated with VOCs in D and E Zone Groundwater

Well	Date Sampled	Increased Lifetime Cancer Risks in Groundwater				
		1,1-DCE	1,2-DCE	PCE	TCE	Total
MWD-3	2/93	--	NA	7.61×10^{-5}	1.81×10^{-5}	9.42×10^{-5}
MWD-3	7/93	NA	NA	1.49×10^{-4}	2.94×10^{-5}	1.79×10^{-4}
MWE-3	2/93	--	--	--	1.94×10^{-7}	1.94×10^{-7}
MWE-3	7/93	--	--	--	--	0.00
MWE-21	6/93 (170 ft)	NA	NA	--	2.30×10^{-5}	2.30×10^{-5}
MWE-21	7/93	--	--	--	1.87×10^{-6}	1.87×10^{-6}
MWD-14	2/93	--	NA	2.31×10^{-6}	9.37×10^{-6}	1.17×10^{-5}
MWD-14	7/93	--	--	4.98×10^{-7}	1.56×10^{-6}	2.06×10^{-6}
MWE-22A	6/93	--	NA	--	7.31×10^{-6}	7.31×10^{-6}
MWE-22	7/93	--	--	1.49×10^{-6}	6.87×10^{-7}	2.18×10^{-6}
MWD-11	2/93	--	--	--	2.94×10^{-7}	2.94×10^{-7}
MWD-11	7/93	--	--	--	1.44×10^{-7}	1.44×10^{-7}
MWD-13	2/93	--	--	--	7.49×10^{-7}	7.49×10^{-7}
MWD-13	7/93	--	--	--	3.25×10^{-7}	3.25×10^{-7}
MWD-12	2/93	--	--	1.73×10^{-5}	8.12×10^{-6}	2.54×10^{-5}
MWD-12	7/93	NA	--	1.90×10^{-5}	9.99×10^{-6}	2.90×10^{-5}
MWD-4	2/93	--	--	--	1.75×10^{-7}	1.75×10^{-7}
MWD-4	7/93	--	--	--	2.94×10^{-6}	2.94×10^{-6}

NA = not applicable; contaminant is not considered a carcinogen.
Note: -- = Not reported.

Table 2-~~8~~ 9 Noncancer Hazard Indices Associated with VOCs in D and E Zone Groundwater						
Well	Date Sampled	Noncancer Hazard Indixes in Groundwater				
		1,1-DCE	1,2-DCE	PCE	TCE	Total
MWD-3	2/93	--	0.01	0.35	--	0.36
MWD-3	7/93	0.38	0.02	0.68	--	1.08
MWE-3	2/93	--	--	--	--	--
MWE-3	7/93	--	--	--	--	--
MWE-21	6/93 (170 ft)	0.09	0.07	--	--	0.16
MWE-21	7/93	--	--	--	--	0.00
MWD-14	2/93	--	0.004	0.01	--	0.014
MWD-14	7/93	--	--	0.002	--	0.002
MWE-22A	6/93	--	0.01	--	--	0.01
MWE-22	7/93	--	--	0.01	--	0.01
MWD-11	2/93	--	--	--	--	--
MWD-11	7/93	--	--	--	--	--
MWD-13	2/93	--	--	--	--	--
MWD-13	7/93	--	--	--	--	--
MWD-12	2/93	--	--	0.08	--	0.08
MWD-12	7/93	0.32	--	0.09	--	0.41
MWD-4	2/93	--	--	--	--	--
MWD-4	7/93	--	--	--	--	--
Note: -- = Not reported.						

2.6.3 Human Health Risks

One specific objective of the human health risk assessment is to provide an analysis of baseline risks and determine the need for action at the Davis Site. Baseline risks are risks that might exist if no remediation or institutional controls were applied to the site (EPA, 1989a). This risk assessment was based on a reasonable maximum exposure (RME) scenario and was developed in accordance with applicable federal, state, and IRP guidance. In developing the RME scenario, the risk assessment used conservative assumptions that estimated exposures to site contaminants well above average exposure levels, but still within the range of possible exposures.

2.6.3.1 Identification of Contaminants of Concern

The COCs that were evaluated in the risk assessment were VOCs detected in soil gas and groundwater petroleum hydrocarbons and polynuclear aromatic hydrocarbons detected both in subsurface soil and in stockpiled soils. The principal COCs were trichloroethylene (TCE) and tetrachloroethylene (PCE) in soil gas and groundwater. The VOCs detected in the

production well located at the site also were evaluated in the risk assessment; these included trihalomethanes (THMs) such as chloroform, formed from the chlorination of organic matter in groundwater, and the pesticide ethylene dibromide (EDB). In the risk assessment, metals in soil were not considered to be COCs because there was no evidence of disposal of metals-containing wastes at the Davis Site.

2.6.3.2 Exposure Assessment

Exposure scenarios considered under current conditions at the Davis Site included the following:

- Onsite workers located outdoors who potentially could be exposed through inhalation of VOCs emitted into the air from soil gas, and emitted into the air from groundwater used for sprinkler irrigation of landscaping

- Onsite workers exposed by direct contact with soil to contaminants in soil during excavation. Pathways of exposure addressed in this scenario were soil ingestion and direct contact with soil

- Onsite workers located indoors who potentially could be exposed by inhalation of VOCs emitted into indoor air from soil gas, from inhalation of VOCs emitted from indoor use of water from the production well, and from skin contact with VOCs in water from the production well

Water pumped from the production well is used for turf irrigation at the site as well as nonpotable consumption (toilets, faucets, showers, and sinks). Drinking water at the Davis Site consists of bottled water. Water from the onsite production well is not used for human consumption. Personnel at the site have used bottled water since 1982 following decreased yield and silting problems with the production well. After the well had been retrofitted, personnel continued to use bottled water because of the preferred taste. Following detection of VOCs in water from the production well, the Air Force mandated the use of bottled water at the Davis Site.

The exposure scenario considered under future conditions at the Davis Site was a resident hypothetically located on the site. There are currently no plans for changing the mission of the Davis Site. Residential land uses in agricultural areas are limited to dwellings only for the preservation of the family farm or for farm employees, with population densities and locations of dwellings limited by County ordinances. Yolo County may prohibit development of residential land uses in agriculturally designated parcels (Yolo County, 1983). Exposure pathways evaluated for the hypothetical future onsite resident include the following:

- Ingestion of groundwater
- Inhalation of VOCs emitted from groundwater
- Skin contact with groundwater

- Soil ingestion
- Skin contact with soil
- Inhalation of VOCs emitted indoors from soil gas

The exposure scenarios for this risk assessment were based on an estimate of the RME. The intent of the RME is to develop a conservative estimate of exposure (i.e., well above the average case) that is still within the range of possible exposures (EPA, 1989a). Specific factors in the RME exposure scenario included the 90 or 95 percentile values for input variables such as inhalation rate, exposure frequency and exposure duration, and exposure concentrations based on the upper 95 percent confidence limit (UCL) of mean concentrations, or the highest concentrations, detected at the site (EPA, 1989b).

Contaminant intakes through each pathway of exposure were calculated as an average daily intake and expressed in units of milligrams of contaminant per kilogram of body weight per day (mg/kg-day). These intake rates represent the amount of chemical at an "exchange boundary" (i.e., skin or lungs). Contaminant intakes were estimated for both adults and children and for both current and future land use. Calculations and input parameters used for estimating intake rates through inhalation, soil ingestion, groundwater ingestion, and dermal contact with soil and groundwater pathways were obtained from EPA (EPA, 1989a; 1990; 1991a). The calculated intake rates then were combined with toxicity criteria values (discussed in Section 2.6.3.3) to characterize potential health risks.

2.6.3.3 Toxicity Assessment

The toxicity assessment determines the relationship between the magnitude of exposure to a chemical and the adverse health effects. This assessment provides, where possible, a numerical estimate of the increased likelihood and/or severity of adverse effects associated with chemical exposure (EPA, 1989a).

For purposes of the toxicity assessment, the COCs have been classified into two broad categories: noncarcinogens and carcinogens. This classification has been selected because health risks are calculated quite differently for carcinogenic and noncarcinogenic effects, and separate toxicity values have been developed for carcinogenic and noncarcinogenic effects. These toxicity values represent the potential magnitude of adverse health effects associated with exposure to chemicals and are developed by EPA and DTSC. Toxicity studies with laboratory animals or epidemiological studies of human populations provide the data used to develop these toxicity values. These values represent allowable levels of exposure derived from the results of toxicity studies or epidemiological studies. The toxicity values are then combined with the exposure estimates (developed in the exposure assessment) to estimate adverse effects from chemicals potentially originating from the site.

Noncarcinogenic effects were evaluated using either Reference Doses (RfDs) or Reference Concentrations developed by EPA. The RfD is a health-based criterion, expressed as chemical intake rate in units of mg/kg-day, used in evaluating noncarcinogenic effects. In general, the RfD is an estimate of a daily exposure to the human population (including

sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime of exposure (EPA, 1989a). If the estimated daily intake of a contaminant is greater than its RfD, there is some concern about adverse health effects associated with exposure to that contaminant.

Health risks associated with carcinogens are evaluated differently from noncarcinogens. Unless evidence to the contrary exists, if a carcinogenic response occurs at the exposure levels studied (typically high doses), it is assumed that responses will occur at all lower doses. Exposure to any level of a carcinogen is then considered to have a finite risk of inducing cancer. Estimates of cancer are calculated using Slope Factors (SFs), which define the ILCR caused by continuous constant lifetime exposure to one unit of carcinogen (in units of risk per mg/kg-day).

2.6.3.4 Risk Characterization

Risk characterization involves estimating the magnitude of the potential adverse health effects under study. This is accomplished by combining the results of the dose-response and exposure assessments to provide numerical estimates of potential health effects. These values represent comparisons of exposure levels with appropriate RfDs and estimates of excess cancer risk. Risk characterization also considers the nature and weight of evidence supporting these estimates, as well as the magnitude of uncertainty surrounding such estimates.

Although the risk assessment produces numerical estimates of risk, these numbers do not predict actual health outcomes. The estimates are calculated to overestimate risk and therefore any actual risks are likely to be lower than these estimates and may even be zero.

The numerical risk estimates are presented in Table 2-~~9~~ 10. Generally, EPA considers action to be warranted at a site when cancer risks exceed 1×10^{-4}. Generally, action is not required for risks falling within 1×10^{-4} to 1×10^{-6}; however, this is judged on a case-by-case basis. Risks less than 1×10^{-6} generally are not of concern to regulatory agencies. An HI (the ratio of chemical intake to the RfD) greater than one indicates that there is some potential for adverse noncancer health effects associated with exposure to the COCs (EPA, 1991b). Table 2-~~8~~ 9 indicates that exposures to noncarcinogenic chemicals are below regulatory concern in all scenarios except hypothetical future residential use. Estimated cancer risks associated with inhalation of VOCs emitted from soil by workers outdoors and direct contact with contaminants in soil also are below regulatory concern.

The results from the risk assessment show that PCE emitted from soil provides the largest contribution to total risk for the outdoor worker exposure scenario. For the indoor worker exposure scenario, estimated cancer risks are driven by the presence of THMs and EDB in production well water. The THMs detected in the production well are bromodichloromethane, bromoform, chlorodibromomethane, and chloroform. Over 80 percent of the total risk in this scenario is associated with these compounds.

Table 2-10
Summary of Estimated Human Health Risks
Davis Global Communications Site[a]

Receptor	Affected Media	Exposure Route	Cancer Risk Estimates: Increased *Lifetime* Cancer Risk[b]	Cancer Risk Estimates: Chemicals Principally Contributing to Risks	Noncancer Effects: Hazard Index[c]	Noncancer Effects: Chemicals Principally Contributing to Noncancer Effects
Onsite Worker–Outdoors	Soil gas, groundwater	Inhalation	3×10^{-7}	Tetrachloroethylene (PCE) in soil gas	<1	N/A
Onsite Worker–Excavation	Soil	Soil ingestion and dermal contact	3×10^{-9}	bis(2-ethylhexyl)phthalate in soil	<1	N/A
Onsite Worker–Indoors (Building 4708)	Soil gas, groundwater	Inhalation and dermal contact with water	3×10^{-5}	PCE in soil gas, ethylene dibromide (EDB), and chloroform in groundwater	<1	N/A
Hypothetical future onsite resident[d]	Groundwater	Ingestion, inhalation, and dermal contact	7×10^{-3}	PCE and trichloroethylene (TCE) in groundwater	>1	PCE, Petroleum hydrocarbons

[a]Health risk estimates based on Reasonable Maximum Exposure (RME) scenarios.
[b]Numerical risk estimates are not predictions of actual health outcomes. These estimates are calculated in a manner that overestimates risk, and thus any actual risks are likely to be lower than these estimates, and may even be zero. EPA generally considers action to be warranted at a site when cancer risks exceed 1×10^{-4}. Generally, action is not required for risks falling within 1×10^{-4} to 1×10^{-6}; however, this is judged on a case-by-case basis. Risks less than 1×10^{-6} generally are not of concern to regulatory agenices.
[c]Hazard index greater than one indicates that there is some potential for adverse noncancer health effects associated with exposure to the containments of concern.
[d]Future residential use of the site is not likely, based on zoning requirements in Yolo County. Hypothetical scenario was included at regulatory agency request to evaluate aquifer nondegradation requirements.

The THMs were detected consistently in samples collected in the production well between November 1986 and September 1988. They are formed from the reaction of dissolved organic matter and chlorine during the chlorination of water. The absence of THMs during other sampling periods may reflect a change in sampling method in which samples are collected prior to the point of chlorination. Therefore, the possibility exists that these contaminants, while not in groundwater, may be present at the point of use, and potentially represent sources of human exposure. The pesticide EDB has been detected in the two most recent sampling rounds, September 1991 and October 1992. It formerly was used as a lead scavenger in antiknock gasoline and as an agricultural soil fumigant. It is highly unlikely that detection of EDB in groundwater is related to activities at the Davis Site.

Tetrachloroethylene and vinyl chloride in groundwater provide the largest contributions to total risk in a hypothetical future residential exposure scenario. In evaluating the significance of this risk estimate, it must be stressed that there is no current pathway of exposure to residents from contaminants in soil or drinking water, according to available information. However, groundwater supplies some drinking water needs in Yolo County, and there could be health risk concerns in the future should groundwater at the Davis Site be developed as a residential supply in the future.

2.6.4 Environmental Risks

An ecological risk assessment was prepared that addressed concerns related to the past and future ecological health of the site. The ecological risk assessment evaluated the possible presence of ecological resources at or near the site that could be threatened by contaminants at the site, the potential presence of exposure pathways from contaminants to those resources, and the potential risks associated with contaminant concentrations in soil and groundwater at the point of exposure to ecological resources. The ecological risk assessment addressed potential impacts associated with anticipated remedial actions at the site and identified mitigation measures that could be required to address those potential impacts. Finally, the ecological risk assessment also provided an evaluation of the proposed remedial actions in comparison with applicable laws and regulations pertaining to ecological resources.

The following steps were involved with the ecological risk assessment:

- Identification of ecological COCs
- Identification of ecological resources
- Exposure assessment
- Toxicity assessment
- Characterization of ecological effect and risk levels
- Evaluation of the effects of remediation

2.6.4.1 Ecological Contaminants of Concern

The COCs for purposes of the ecological risk assessment were: diesel petroleum hydrocarbons in the soil piles at the site; and for remedial actions involving discharge of treated water to surface water the COCs were: antimony, lead, nickel, iron, selenium, and thallium.

2.6.4.2 Identification of Ecological Resources

The critical ecological resources at the Davis Site are the burrowing owl and Swainson's hawk. The owl could be at risk from petroleum-contaminated soil. Food sources or other ecological requirements of the owl are not threatened by onsite conditions or potential remediation activities; however, other habitat requirements could potentially be vulnerable. The owl uses existing burrows, primarily California ground squirrel burrows, for shelter and also for nesting. With minimal dilution and ventilation in the burrows, the air could reach equilibrium with volatile or semivolatile contaminants in the soil. If the bird remains in the burrow for extended periods, such as during breeding season, there could be significant exposure through inhalation. This could pose a risk to individuals and also population breeding success.

Although the foraging habitat onsite is marginal for the Swainson's hawk, a risk to the hawk could result from remediation-related activities that reduce the size or quality of foraging habitat. Modification of other significant areas associated with remediation could pose a similar reduction in habitat.

2.6.4.3 Exposure Assessment

The following are potential exposure pathways from site contaminants to ecological receptors:

- Intake of petroleum hydrocarbon contaminants in the soil piles, used as habitat by burrowing owls and ground squirrels, through soil ingestion. Also, petroleum hydrocarbons could volatilize within enclosed burrows, potentially resulting in inhalation exposures.

The exposure concentrations of petroleum hydrocarbons were estimated from concentrations measured in samples from the soil piles. The 95 percent UCL of the average concentration of total petroleum hydrocarbon (TPH) was used as the exposure concentration. Average concentrations in groundwater, calculated from results from six monitoring wells, were used as exposure concentrations of metals in surface water.

2.6.4.4 Toxicity Assessment

Ecological effect levels for ingestion of petroleum hydrocarbons in soil by small mammals (ground squirrels) were estimated from acute toxicity data developed in rats, and published in the technical literature. Levels of exposure to petroleum hydrocarbons producing acute

toxicity were adjusted using uncertainty factors to estimate no-observed-adverse-effect levels (NOAELs). Ecological effect levels for inhalation of petroleum hydrocarbon vapors emitted from soil were estimated from subchronic (90-day duration) inhalation toxicity studies performed on petroleum hydrocarbon fuels and published in the technical literature. Levels of exposure evaluated in these studies were adjusted by uncertainty factors to estimate NOAELs for inhalation exposure.

Information was not available to quantify the risks to burrowing owls from petroleum-hydrocarbon-contaminated soil. However, a qualitative review of the toxicity of petroleum products to birds suggests that the concentrations of petroleum hydrocarbon contaminants in the soil piles are not likely to pose a significant risk to burrowing owls. Birds can be affected by petroleum products through external oiling, ingestion, egg oiling, and habitat changes (Albers, 1991). Adverse effects have been observed in aquatic birds exposed to free petroleum hydrocarbon product in water and tidal areas. Exposures to traces of petroleum hydrocarbon contaminants in soil have not been reported to produce adverse effects in terrestrial birds.

2.6.4.5 Characterization of Ecological Risks and Effect Levels

Information developed in the exposure assessment and toxicity assessment portions of the ecological risk assessment were used to develop effect levels for petroleum hydrocarbons in soil. The maximum concentration of TPH in the soil piles exceeded the soil ingestion effect level for mammals; however, the 95 percentile UCL of the mean concentration (UCL = 91 mg/kg, mean = 55 mg/kg) is less than this effect level. All concentrations of TPH in the soil piles fell below the inhalation effect level. On the basis of this evaluation, petroleum hydrocarbons in the soil piles would not be an ecological COC for mammals.

As discussed previously, information was not available to quantify the risks to burrowing owls from petroleum-hydrocarbon-contaminated soil. However, the toxicity of petroleum hydrocarbons to birds is most often associated with exposure to free hydrocarbon product. Ingestion of trace concentrations sorbed to soil particulates is not likely to produce significant adverse effects or decreased fertility, or increase the susceptibility of burrowing owls to starvation, disease, or predation. Exposures to embryos are not likely to occur because free product is not present to cause oiled plumage in adult birds. It is not certain if inhalation exposures could be associated with significant adverse effects. An important consideration is that burrowing owls would not shelter or nest continuously in the burrows, reducing the potential duration of inhalation exposure.

2.7 Description of Alternatives

The Feasibility Study (FS) for the Davis Site evaluated three alternatives along with the no-action alternative for remedial action. The alternatives addressed soil contamination only, groundwater contamination only, and then a combination of soil and groundwater contamination. <u>Subsequent to the release of the Final RI/FS Report, McClellan AFB</u>

reevaluated the selection of background target volumes for site remedial action. Specifically, McClellan AFB evaluated the effects of the remedial action on the time and cost of achieving IROD objectives while still meeting agency requirements and not significantly increasing risk levels. The evaluation resulted in the selection of a target volume that is based on MCLs instead of background levels. For this IROD, a fifth alternative was evaluated. Alternative 5 is the same as Alternative 4 except that only one target volume is considered, the target volume that represents the volume of groundwater contaminated above MCLs in the B and C zones. The alternatives are presented in Table 2-~~10~~ 11. Soil vapor extraction was evaluated for the soil contamination, and groundwater extraction and treatment was evaluated for the groundwater contamination. ~~For the groundwater contamination, two target volumes were considered. Target Volume 1 encompassed B and C zone contamination, and Target Volume 2 encompassed B, C, D, and E zone contamination.~~ No treatability testing for particular treatment methods has been performed. The chosen treatment methods are proven technologies that have been performed at other sites.

Table 2-~~10~~ 11
Summary of Alternatives

Alternative	Cleanup Options			
	No-Action Vadose Zone	No-Action Groundwater	Soil Vapor Extraction	Groundwater Extraction
Alternative 1	✓	✓		
Alternative 2		✓	✓	
Alternative 3	✓			✓
Alternative 4			✓	✓
Alternative 5			✓	✓

2.7.1 Alternative 1: No-Action

The No-Action Alternative serves as a "baseline" against which other alternatives are compared. This alternative is evaluated to determine the risks to public health and the environment if no action were taken to contain or treat the VOC contamination. The No-Action Alternative for the vadose zone would leave the VOC contaminants in place within the soil, where they would continue to migrate either to the surface or percolate downward to the groundwater. For the groundwater, the No-Action Alternative would allow contaminants in the A, B, C, D, and E zones to continue to move laterally and vertically with the possibility of moving beyond the Davis Site boundaries. Alternative 1 would involve continuing vadose zone and groundwater monitoring, but no additional cleanup activities would be conducted.

2.7.2 Alternative 2: Soil Vapor Extraction Only

Alternative 2 involves capturing and treating contaminated soil vapor within the upper 40 feet of the vadose zone using extraction wells connected to a vacuum pump system. No extraction and treatment of the groundwater would take place.

The SVE system strips VOCs from contaminated soil by pulling air through the contaminated soil. As contaminated soil vapor is removed, it is gradually replaced with clean air from the ground surface. The continued replacement of contaminated air with clean air leads to the gradual decontamination of the soil.

To use the SVE process, existing SVMWs would be turned into extraction wells by attaching a vacuum pump system. Subsurface monitoring would be conducted while the SVE system was operating to provide information about how well the system is working. This information would be used to check the rate of airflow in the area of contamination. At a minimum, quarterly soil gas samples would be taken to evaluate cleanup. It is estimated to take about 10 years for the SVE system to remove contamination from the vadose zone.

The extracted soil vapor contaminants will be destroyed using a granular activated- carbon treatment system. With this system the vapors adsorb onto a media where the contaminants are converted to the activated carbon media and the discharge is free of contaminants. Changeout of the spent carbon is required on a routine basis. It is estimated that between 1,500 and 3,000 pounds of carbon would be used each year. During changeout, the spent charbon would be replaced with new or regenerated carbon. The spent carbon would be transported by the carbon vendor to be thermally regenerated. None of the regeneration will take place onsite.

2.7.3 Alternative 3: Groundwater Extraction Only

Alternative 3 includes extracting and treating groundwater, but no action is taken in the vadose zone. This alternative was evaluated for ~~the~~ two target volumes. For Target Volume 1, the wells are designed to capture ~~contaminated~~ groundwater within the B and C zones that is above background levels of contamination. ~~f~~For Target Volume 2, the wells are designed to capture ~~contaminated~~ groundwater from all zones that is above background levels of contamination. A plan view of the background and MCL-based target volumes for each zone is shown in Figure 2-~~7~~8. The extracted groundwater would be filtered to remove any suspended solids and then treated for VOCs using advanced UV oxidation. Two other treatment methods, air stripping and granular activated-carbon beds, were originally proposed, but during evaluation of this alternative advanced UV oxidation was determined to be the most suitable treatment method for the Davis Site. The advanced UV oxidation system uses UV light in combination with an oxidant, such as hydrogen peroxide, to destroy the contaminants in the groundwater.

In conjunction with the advanced UV oxidation, granular activated carbon will be used as a final polishing treatment method before the groundwater is released for injection. It is estimated that up to 2,000 pounds of carbon will be spent each year polishing the treated groundwater. The spent carbon will be changed out with the same process as that for the SVE treatment unit.

If Alternative 3 were selected for the Davis Site, it is estimated that cleanup might take over 200 years because the vadose zone contamination would be continuing source of groundwater contamination.

2.7.4 Alternative 4: Groundwater and Soil Vapor Extraction

Alternative 4 is a combination of Alternatives 2 and 3 from above. Alternative 4 addresses vadose zone contamination and the same two target volumes of groundwater contamination as Alternative 3. In the Feasibility Study, Alternative 4 was the chosen alternative. However, further evaluation since the release of the Final FS has led to the development and selection of Alternative 5 as the chosen alternative.

~~The FS Alternative 4 was chosen as the proposed cleanup option. This alternative involves using SVE to treat contamination in the vadose zone and extraction and treatment of groundwater using advanced UV oxidation. Treatment and end-use options for soil vapor and groundwater contamination are shown in Table 2-11.~~

2.7.5 Alternative 5: Groundwater Extraction to MCLs and Soil Vapor Extraction

Alternative 5 is the same as Alternative 4 except for groundwater contamination, only one target volume is considered, the target volume that represents groundwater in the B and C zones contaminated above MCLs. Alternative 5 includes both SVE to treat contamination in the vadose zone and containment of B and C zone contaminated groundwater using extraction and treatment. Treatment and end-use options for soil vapor and groundwater contamination are shown in Table 2-12.

Table 2-1~~1~~2 Treatment and End-Use Options Evaluated for Soil Vapor and Groundwater Contamination				
Contaminated Media	**Treatment Methods**	**Treatment Method Selected**	**End-Use Options Evaluated**	**End-Use Option Selected**
Groundwater	UV Oxidation/Granular Activated Carbon Polish Granular Activated Carbon Air Stripping	✓	Wilson Park Irrigation Wallace Farms Irrigation Surface Water Discharge to Putah Creek Onsite Groundwater Injection Onsite Irrigation	 ✓ ✓ ✓
Soil Vapor	Catalytic Oxidation Purus Padre Electron Beam Technology Granular Activated Carbon	 ✓	Not Applicable	Vented to Atmosphere

2.8 Summary of the Comparative Analysis of Alternatives

In this section, the remedial action alternatives are compared in detail in terms of the nine criteria set forth in the NCP. ~~The criteria and a~~A short description of each of the criteria is provided in Figure 2-~~9~~10. A comparison of the ~~four~~ five cleanup alternatives using the nine criteria is presented in Table 2-1~~2~~3.

~~2.8.1 Overall Protection of Human Health and the Environment~~

~~The No-Action Alternative would not be protective of human health and the environment. Alternative 2 effectively removes the long term source of groundwater contamination by removing the contaminants in the vadose zone. However, the contamination currently in the groundwater would remain where it could migrate laterally and vertically into uncontaminated portions of the aquifers. Alternative 3 would effectively contain groundwater contamination. However, a continuing source of contamination exists in the vadose zone which would lengthen the remediation period to over 200 years. The result of only groundwater extraction would be overall protection of human health and the environment. Implementation of Alternative 4 provides overall protection of human health and the environment.~~

Table 2-1~~2~~3
Comparison of Cleanup Alternatives

Criteria Description	Alternative 1: No Action on Vadose Zone No Action on Groundwater	Alternative 2: SVE on Vadose Zone No Action on Groundwater	Alternative 3: No Action on Vadose Zone Extract and Treat Groundwater	Alternative 4: SVE on Vadose Zone Extract and Treat Groundwater[a]	Alternative 5: SVE on VZ Extract and Treat Groundwater Above MCLs
1. Overall Protection of Human Health and Environment	No	No	Yes	Yes	Yes
2. Compliance with ARARs	No	No[a]	Yes	Yes	Yes
3. Long-term Effectiveness and Permanence	No	No[b]	Yes	Yes	Yes
4. Reduction of Toxicity, Mobility, and Volume through Treatment	No	No[b]	No[c]	Yes	Yes
5. Short-Term Effectiveness	No	No[b]	No[c]	Yes	Yes
6. Implementability	Yes	Yes	Yes	Yes	Yes
7. Cost (present worth)	~~No Capital Cost[d]~~ $4,600,000[d]	~~$600,000[e]~~ $2,400,000[e]	Target Volume 1: ~~$14,300,000~~ 10,900,000[f] Target Volume 2: ~~$23,900,000~~ 17,000,000[f]	Target Volume 1: ~~$7,000,000~~12,700,000[g] Target Volume 2: ~~$10,200,000~~18,800,000[g]	$8,000,000[h]
8. State Acceptance	No	No	No	~~TV1~~Yes	Yes
9. Community Acceptance	No	?	?	Yes	Yes

[a]Does not satisfy chemical-specific ARARs.
[b]Does not address groundwater contamination.
[c]Does not address vadose zone contamination.
[d]Costs will be incurred for continued monitoring for 140 years.
[e]Estimated cleanup costs for 10 years.
[f]Estimated cleanup costs for 200 years.
[g]Estimated cleanup costs for ~~30~~ 140 years.
[h]Estimated cleanup costs for 20 years.

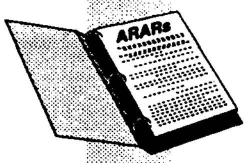
~~Note:~~

~~a — Preferred Alternative~~

NINE CRITERIA USED TO EVALUATE CLEANUP ALTERNATIVES

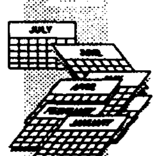
Overall protection of human health and the environment

Addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through engineering or institutional controls.



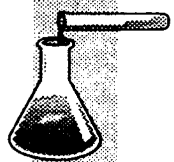
Compliance with applicable or relevant and appropriate requirements (ARARs)

Whether a remedy will meet all federal, state, and local environmental statutes and/or provide grounds for requesting a waiver.



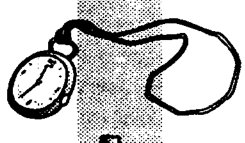
Longterm Effectiveness and Permanence

The ability of a remedy to maintain reliable protection of human health and the environment over time, after cleanup goals have been met.



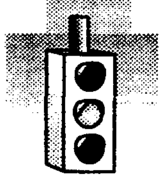
Reduction of toxicity, mobility, or volume through treatment

The anticipated ability of a remedy to reduce the toxicity, mobility, and volume of the hazardous components present at the site.



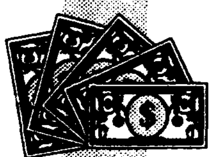
Short-term effectiveness

The period of time needed to complete the cleanup and address any adverse impact on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.



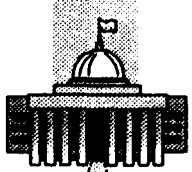
Implementability

The technical and administrative feasibility of a remedy including the availability of materials and services needed to carry out a particular option.



Cost

The estimated capital and operation and maintenance costs of each alternative.



State acceptance

Whether, based on its review of the information, the state concurs with, opposes, or has no comment on the preferred alternative.

Community acceptance

Whether concerns are addressed by the remedy, and whether the community has a preference for a remedy. Public comment is an important part of the final decision.

FIGURE 2-10
NINE CRITERIA USED TO EVALUATE CLEANUP ALTERNATIVES
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

RDD1533_25

CH2M HILL

~~2.8.2 Compliance with ARARs~~

~~Alternative 1 would not comply with Applicable, Relevant, and Appropriate Requirements (ARARs) because the groundwater would continue to have contaminant concentrations above maximum contaminant levels. Alternative 2 does not address groundwater contamination, and chemical specific ARARs will not be met. Alternatives 3 and 4 would be designed to meet all ARARs. Under these alternatives, contaminated groundwater would be captured and treated until chemical specific ARARs were met. Both alternatives would be built and operated to comply with action specific and location specific ARARs.~~

~~2.8.3 Long-Term Effectiveness and Permanence~~

~~Alternative 1 would not alter the threats posed by vadose zone or groundwater contamination at the site. Therefore, Alternative 1 does not provide an effective or permanent long-term solution to the contamination problem at the Davis Site.~~

~~An SVE system would be used in Alternative 2 to reduce VOC levels in the vadose zone. However, this alternative does nothing to address the groundwater concentrations. Therefore, Alternative 2 does not fulfill long-term effectiveness and permanence requirements.~~

~~Groundwater extraction would be used under Alternative 3 to capture and treat the contaminated groundwater. Under this alternative, contaminants currently in the vadose zone would be allowed to migrate into the groundwater over a time frame on the order of 200 years, meaning that the groundwater extraction system would need to be operated over an extreme time span. Alternative 4 includes both soil vapor and groundwater extraction. Both of these alternatives could provide for long-term effectiveness and permanence.~~

~~2.8.4 Reduction of Toxicity, Mobility, or Volume through Treatment~~

~~This criterion addresses the degree to which contamination is reduced in toxicity, mobility, or volume *through treatment*. The alternatives are evaluated against this criterion for two separate cases. First, are there reductions with respect to the contaminants that actually remain in the subsurface? Second, are there reductions with respect to the contaminants that have been removed from the ground and are now present in some form at the ground surface?~~

~~Alternative 1 invokes no treatment whatsoever and therefore does not reduce contaminant toxicity, mobility, or volume through treatment.~~

~~The SVE and treatment system proposed for Alternative 2 would impact soil contaminant toxicity, mobility, and volume, but the toxicity, mobility, and volume of contaminants in the groundwater would not be impacted by Alternative 2.~~

~~Extraction of groundwater only (Alternative 3) will physically capture the contamination in Target Volume 1, reducing the subsurface toxicity, mobility, and volume within Target Volume 1. The low levels of contamination that currently reside deeper in the subsurface (C to D zone and deeper) may not be impacted by the action and may not experience reductions in toxicity, mobility, or volume. Data collection and evaluation during remedial action will be performed to check on the reductions in toxicity, mobility and volume in the D and E zones. Alternative 3 does nothing to address the toxicity, mobility, or volume of contaminants above the water table.~~

~~Alternative 4 addresses toxicity, mobility, and volume of contaminants above the water table as described for Alternative 2, and below the water table as described for Alternative 3. It is the most thorough alternative with respect to reducing toxicity, mobility, and volume.~~

~~2.8.5 Short Term Effectiveness~~

~~Because no remedial action occurs under Alternative 1, no short term effects will occur that differ from the current condition.~~

~~Implementation of an SVE system (Alternative 2) will never achieve the remedial response objectives at the site because it fails to address the groundwater contamination and therefore does not fulfill the short term effectiveness criterion.~~

~~Alternative 3 does not meet this criterion because it is estimated that this alternative will take an extreme period of time to achieve remedial response objectives (200 years or longer). Alternative 4 meets the short term effectiveness criterion because remedial response objectives can be achieved within a 30 year time frame.~~

~~2.8.6 Implementability~~

~~All of the alternatives are fully implementable at the Davis Site. The technologies are well proven, and no impediments to implementing the actions have been identified.~~

~~The equipment and specialists needed to implement the alternatives are expected to be readily available. The Davis Site is located near the greater Sacramento metropolitan area, which should be able to provide most of the resources needed.~~

<u>2.8.1 Overall Protection of Human Health and the Environment</u>

<u>The No-Action Alternative (Alternative 1) would not be protective of human health and the environment. While there are no significant risks to human health or the environment under current conditions, groundwater contaminants under the Davis Site are not contained and could further impact potential future water supplies.</u>

Alternative 2 would not be protective of human health and the environment. Alternative 2 effectively removes the long-term source of groundwater contamination by removing the contaminants in the vadose zone. However, contamination existing in groundwater is not contained and could further impact potential future water supplies.

Alternative 3 would be protective of human health and the environment by containing groundwater contamination and preventing further impacts to potential future water supplies.

Alternative 4 would be protective of human health and the environment by containing groundwater contamination and preventing further impacts to potential future water supplies.

Alternative 5 would be protective of human health and the environment by containing groundwater contamination and preventing future impacts to water supplies.

2.8.2 Compliance with ARARs

The No-Action Alternative (Alternative 1) would not comply with Applicable or Relevant and Appropriate Requirements (ARARs) by leaving contaminants in groundwater that exceed Federal and State Maximum Contaminant Limits (MCLs), and that do not meet the objectives of the State's Non-Degradation Policy.

Alternative 2 would not comply with ARARs by leaving contaminants in groundwater that exceed Federal and State MCLs, and that do not meet the objectives of the State's Non-Degradation Policy.

Alternative 3 would comply with ARARs by reducing contaminant concentrations in groundwater to levels less than Federal and State MCLs, and to levels that achieve the objectives of the State's Non-Degradation Policy. Alternative 3 would be designed, built, and operated to comply with action-specific and location-specific ARARs.

Alternative 4 would comply with ARARs by reducing contaminant concentrations in groundwater to levels less than Federal and State MCLs, and to levels that achieve the objectives of the State's Non-Degradation Policy. Alternative 4 would be designed, built, and operated to comply with action-specific and location-specific ARARs.

Alternative 5 would be designed, built, and operated to comply with ARARs by preventing further degradation of water supplies and by reducing contaminant concentrations to Federal and State MCLs. While cleanup levels are not specified in this IROD, Alternative 5 supports the Final ROD for the Davis site, which will specify cleanup levels as ARARs to be achieved by the selected remedy.

2.8.3 Long-Term Effectiveness and Permanence

The No-Action Alternative (Alternative 1) does not address the threats to groundwater resources, and potentially to public health and the environment, from contamination in the

vadose zone and groundwater. Therefore, Alternative 1 does not provide an effective long-term or permanent remedy to the contamination at the Davis Site.

Alternative 2 would reduce contaminant levels in the vadose zone with an SVE system, reducing the potential for future groundwater contamination. However, Alternative 2 does not address existing groundwater contaminants, which could further impact potential future water supplies. Therefore, Alternative 2 does not provide an effective long-term or permanent remedy to the contamination at the Davis Site.

Alternative 3 would contain and remove groundwater contaminants by using groundwater extraction. Therefore, Alternative 3 would provide an effective long-term or permanent remedy to the contamination at the Davis Site.

Alternative 4 would contain and remove groundwater contaminants by using groundwater extraction. Alternative 4 would remove contaminants from soil by using SVE. Therefore, Alternative 4 would provide an effective long-term or permanent remedy to the contamination at the Davis Site.

Alternative 5 would contain and remove groundwater contaminants by using groundwater extraction. Alternative 5 would remove contaminants from soil by using SVE. Therefore, Alternative 5 would provide an effective long-term or permanent remedy to the contamination at the Davis Site.

2.8.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The alternatives are evaluated against this criteria for two cases. First, are there reductions in the levels of contaminants that are in the vadose zone or groundwater? Second, are there reductions in the levels of contaminants in treated effluent (water or air)?

Alternative 1 involves no form of treatment, and therefore does not reduce contaminant toxicity, mobility, or volume.

Alternative 2 would reduce the toxicity, mobility, and volume of contaminants in the vadose zone, but would not reduce the toxicity, mobility, and volume of contaminants in groundwater.

Alternative 3 would reduce the toxicity, mobility, and volume of contaminants in groundwater, but would not reduce the toxicity, mobility, and volume of contaminants in the vadose zone.

Alternative 4 would reduce the toxicity, mobility, and volume of contaminants in both the vadose zone and groundwater. Alternative 4 ~~best~~ achieves the criterion for reduction of toxicity, mobility, and volume of contaminants at the Davis Site.

Alternative 5 would reduce the toxicity, mobility, and volume of contaminants in both the vadose zone and groundwater. Alternative 5 achieves the criterion for reduction of toxicity, mobility, and volume of contaminants at the Davis Site.

Risk reduction across the remedial action objectives is presented in Figure 2-11. This figure shows the relationship between remedial action goals, target volumes in groundwater that achieve those remedial action goals, and the percent risk reduction associated with contaminants and treatment of each target volume. The range of risk reduction is from 98.5 percent for achieving MCLs to 99.85 percent for achieving the detection limit. Overall, the risk reduction does not vary significantly between the remedial action goals, suggesting there is little difference in risk reduction between the three different target volumes.

2.8.5 Short-Term Effectiveness

The No-Action Alternative (Alternative 1) would have no short-term effectiveness in remediating contamination at the Davis Site.

Alternative 2 would be effective in the short term in reducing contaminant concentrations in the vadose zone, but would not be effective in the short-term for addressing contamination in groundwater.

Alternative 3 is designed to contain and extract contaminants from groundwater. However, Alternative 3 does not address existing contamination in the vadose zone. Vadose zone contaminants could continue to migrate to groundwater. Modeling results indicate that vadose zone contamination could continue to migrate to groundwater over the next 200 years. Therefore, Alternative 3 would not be effective in the short-term for addressing contamination in groundwater.

Alternative 4 involves technologies for removing and treating contaminants from both the vadose zone and groundwater. Modeling results for Alternative 4 indicate that remedial action goals both in the vadose zone and in groundwater could be achieved within 30 years. Alternative 4 achieves the criterion for short-term effectiveness in remediating contaminants at the Davis Site.

Alternative 5 involves technologies for removing and treating contaminants from both the vadose zone and groundwater. Alternative 5 is identical to Alternative 4, except that it would contain and remove contaminants to Federal and State MCLs. Therefore, Alternative 5 would likely achieve remedial action goals in less time than required for Alternative 4. Alternative 5 achieves the criterion for short-term effectiveness in remediating contaminants at the Davis Site.

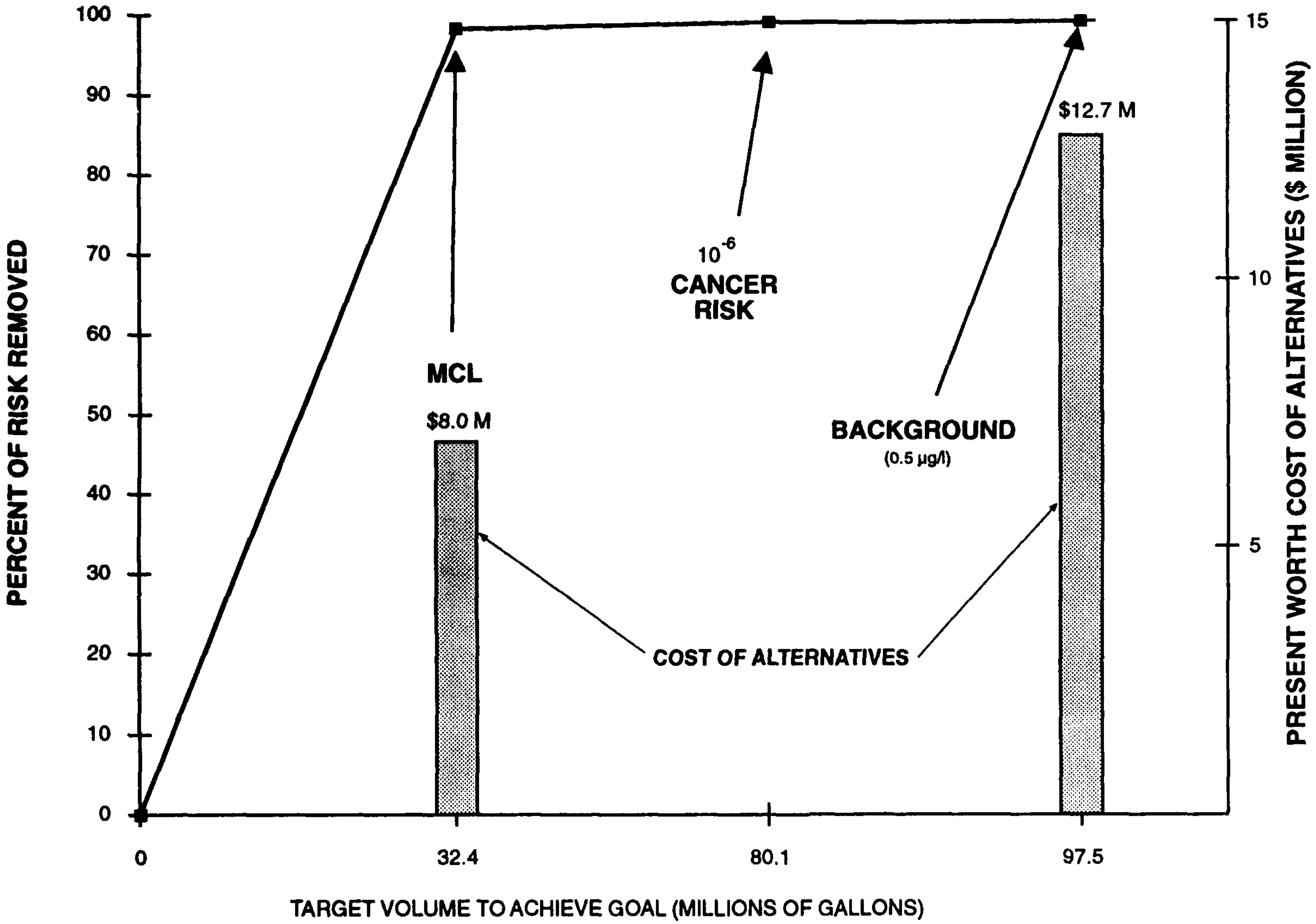


FIGURE 2-11
RISK REDUCTION ACROSS TARGET VOLUMES
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

CH2M HILL

RDD1533_004

2.8.6 Implementability

The No-Action Alternative (Alternative 1) involves maintaining the existing programs for vadose zone and groundwater monitoring. This alternative is fully implementable.

Alternative 2 uses technologies that are well proven, and no impediments to implementing these technologies have been identified. The equipment and specialists needed to implement this alternative are expected to be readily available. The Davis Site is located near the greater Sacramento metropolitan area, which should be able to provide most of the resources that would be needed to implement this alternative.

Alternative 3 uses technologies that are well proven, and no impediments to implementing these technologies have been identified. The equipment and specialists needed to implement this alternative are expected to be readily available. The Davis Site is located near the greater Sacramento metropolitan area, which should be able to provide most of the resources that would be needed to implement this alternative.

Alternative 4 uses technologies that are well proven, and no impediments to implementing these technologies have been identified. The equipment and specialists needed to implement this alternative are expected to be readily available. The Davis Site is located near the greater Sacramento metropolitan area, which should be able to provide most of the resources that would be needed to implement this alternative.

Alternative 5 uses technologies that are well proven, and no impediments to implementing these technologies have been identified. The equipment and specialists needed to implement this alternative are expected to be readily available. The Davis Site is located near the greater Sacramento metropolitan area, which should be able to provide most of the resources that would be needed to implement this alternative.

2.8.7 Cost

The estimated capital, annual operating, and total present worth costs of the alternatives are summarized in Table 2-1~~3~~4. In this table, capital costs include only the initial outlays for each alternative. Replacement costs and salvage values are reflected in the total present worth cost. The total present worth cost is based on 140 years for Alternative 1, 10 years for Alternative 2, 200 years for Alternative 3, ~~and 30~~ 140 years for Alternative 4, and 20 years for Alternative 5. A more detailed cost analysis is provided in Chapter 6 of the RI/FS report (CH2M HILL, 1993). Replacement costs were assumed to be the same as initial capital costs and were applied on a 20-year interval. The costs for Alternative 5 are based on contractor's estimates. The capital costs for Alternatives 3 and 4 are based on capital costs presented in the RI/FS report and then adjusted upward on the basis of contractor's estimates.

Table 2-1~~3~~4 Estimated Capital, Operating, and Present Worth Costs for Alternatives			
Alternative	**Capital Cost ($)**	**Annual O&M ($)**	**Total Present Worth Costs ($)**
1	0	230,000	4,600,000
2	194,000	~~59,000~~ 289,000	~~600,000~~ 2,400,000
3	TV1: ~~1,030,000~~2,002,000 TV2: ~~1,767,000~~2,459,000	TV1: 388,000 TV2: 576,000	TV1: ~~14,300,000~~10,900,000 TV2: ~~23,900,000~~17,000,000
4	TV1: ~~1,224,000~~2,363,000 TV2: ~~1,961,000~~3,839,000	TV1: 447,000 TV2: 635,000	TV1: ~~7,000,000~~12,700,000 TV2: ~~10,200,000~~18,800,000
5	2,363,000	456,000	8,000,000

~~2.8.8 State/Support Agency Acceptance~~

~~The Cal-EPA has stated that both SVE and treatment, and groundwater extraction and treatment be implemented at this site. Remedial goals have been established for the groundwater and soil contamination. It is the opinion of Cal EPA that the remedial actions be implemented and evaluated before final remedial goals are established. The Cal EPA is in favor of implementing SVE for the contaminated soil and groundwater extraction for Target Volume 1. Data analysis during Target Volume 1 remediation will give an indication of contaminant concentrations from the D and E zones and whether the pumping from the B and C zones is affecting contaminant levels in the lower zones.~~

2.8.8 State Agency Support/Acceptance

Remedial goals (described in Section 1.5) have been developed in this IROD for contamination in the vadose zone and groundwater at the Davis Site. However, Cal-EPA believes that remedial actions should be implemented and evaluated prior to the establishment of the final remedial action goals for the Davis Site.

The No-Action Alternative (Alternative 1) is not supported or accepted by Cal-EPA because it does not meet ARARs or achieve the remedial goals developed for the Davis Site.

Alternative 2 is not supported or accepted by Cal-EPA because it does not meet ARARs or achieve the remedial goals developed for the Davis Site.

Alternative 3 is not supported or accepted by Cal-EPA because it does not meet ARARs or achieve the remedial goals developed for the Davis Site.

Cal-EPA supports and accepts Alternative 4, which involves installation and operation of the SVE and treatment system, and implementation of a groundwater extraction and treatment system at the Davis Site. Cal-EPA supports and accepts implementation of Alternative 4 on Target Volume 1 (groundwater contamination in the B and C zones). Data collected during remedial action on Target Volume 1 will provide an indication of whether pumping of groundwater from the B and C zones is affecting contaminant concentrations in the lower D and E zones.

Cal-EPA supports and accepts Alternative 5, which involves installation and operation of the SVE and treatment system, and implemention of a groundwater extraction and treatment system at the Davis Site. Cal-EPA supports and accepts implementation of Alternative 5 for groundwater contamination that exceeds Federal and State MCLs in the B and C zones. Data collected during remedial action on this groundwater contamination will provide an indication of whether pumping of groundwater from the B and C zones is affecting contaminant concentrations in the lower D and E zones.

2.8.9 Community Acceptance

Community acceptance is measured by the questions and concerns raised by the community during the public comment period for the Proposed Plan. The community concerns and questions and appropriate responses are given in Section 3.0, Responsiveness Summary. There was no objection by the community to implementing the Proposed Plan. Community concerns raised about the different alternatives are discussed below:

- Comments were raised as to whether the fastest method for cleanup was being applied at the Davis Site. McClellan AFB responded that developing an interim remedy and using Alternative 4 provided the fastest cleanup.

- One comment was raised as to the need for remedial action beyond SVE (groundwater extraction that will be used in Alternatives 3 and 4) if the risk assessment predicted no current exposures to contaminants in groundwater. McClellan AFB responded that SVE (Alternative 2) did not meet several of the other evaluation criteria used for selecting remedial action alternatives.

- Comments were raised about the control efficiency of offgas treatment for the SVE system, health risks associated with VOC emissions, and noise levels, from the SVE system (that will be used in Alternatives 2 and 4). McClellan AFB provided added information on the control efficiency and expected noise levels, and stated that a health risk assessment will be performed prior to operation of the SVE system to evaluate health risks associated with VOC emissions. The design of the SVE system also will be reviewed by the Yolo/Solano Air Quality Management District (YSAQMD) prior to its construction.

- A comment was raised about the expected draw-down of the water table associated with operation of the groundwater extraction system (that will be used in Alternatives 3 and 4). McClellan provided a comparison of the draw-down from operation of the groundwater extraction system with the existing regional decline in the water table.

- A comment was raised about the availability of treated water produced from the groundwater extraction system (that will be used in Alternatives 3 and 4). McClellan AFB responded that the water will be reinjected into the aquifer, and that irrigation is only a temporary, emergency use should reinjection be interrupted.

2.9 Selected Remedy

The selected remedy consists of two main components, one addressing vadose zone contamination and the other addressing groundwater contamination. The first component consists of using SVE to collect and treat soil vapor contamination using soil vapor extraction wells and granular activated carbon. The objective for vadose zone remediation is to remove the VOC contamination to a level where it no longer acts as a continuing source of contamination for the groundwater. The cleanup goal for soil gas is 500 ppbv of PCE. The second component of the selected remedy consists of containment of the B and C zone groundwater that is contaminated above MCLs. The containment will be implemented using groundwater extraction wells, a UV oxidation treatment system, and groundwater injection.

On the basis of the evaluation criteria and site conditions, Alternative ~~4~~ 5 was chosen as the remedial action for implementation for this IROD. Alternative 5 addresses the vadose zone contamination and the MCL-based target volume in the B and C zones ~~Target Volume 1 (B and C zones only) was chosen~~ for groundwater extraction, treatment, and end use. The following sections detail the chosen alternative for the groundwater and soil contamination. No adverse impacts to human health or the environment are expected during the construction and implementation period.

2.9.1 Description of Remedy for Contaminated Groundwater

A groundwater extraction system will be used ~~to capture~~ for containment and removeal of contaminat~~ion~~ed ~~in the~~ groundwater above MCLs from the B and C zones. (A plan view of the MCL-based target volume for each zone is shown in Figures 2-~~7~~ 8 and 2-12.) The volume of water targeted for ~~capture~~ containment totals approximately 32 million gallons and resides in the ~~A,~~ B and C zones. ~~Over 80 percent of the known contamination at the site resides above the D zone (see Figure 2-7).~~ The extraction well locations are shown in Figure 2-~~10~~ 12. The target volume for containment is groundwater contaminated above MCLs.

~~According to groundwater capture modeling,~~ Up to four extraction wells with ~~an estimated required~~ a combined flow rate ~~up to~~ of approximately 380 gallons per minute (gpm) are needed to capture the contamination in the B and C zones. These extraction rates ~~were~~ are considered adequate to capture the target volumes under summer groundwater conditions. During winter conditions, total flow rates can be reduced to one-third of the summer condition extraction rates, as shown in Table 2-145.

An implementation schedule is shown in Table 2-156. The data gap analysis schedule is outlined in ~~the t~~Table 2-16. Monitoring is a necessary component of the groundwater extraction system. Water level measurements will be taken from monitoring wells or piezometers to assess if the groundwater within the target volume is being hydraulically captured. After the system is initially operated, all of the existing monitoring wells not being used for extraction and any additional water level measuring points will be measured weekly for a period of up to 6 months before the data evaluation is performed. A performance evaluation report will be prepared to assess the first 6 months of operation of the groundwater extraction and treatment system. Water levels will be measured monthly after the initial 6 months and when the extraction rates are kept constant. Water levels will be measured weekly for 1 month after the extraction rates are adjusted significantly or when nearby agricultural wells begin or cease pumping. Water quality data will be collected to monitor possible changes in the target volume geometry and also to characterize the ~~influent~~ water ~~streams~~ that enters the groundwater treatment system.

Table 2-145
Estimated Flow Rates for Target Volume Capture

Well Name	Summer Flow Rate (gpm)	Winter Flow Rate (gpm)
EW-1B	65 to 80	20 to 25
EW-2C	60 to 100	20 to 25
EW-3C	40 to 50	15 to 20
EW-4C	100 to 150	30 to 40
Total	**265 to 380**	**85 to 110**

Table 2-1~~5~~6 Implementation Schedule		
Activity	**Start Date**	**End Date**
B/C Groundwater Remedy Design	July 1994	December 1994
B/C Groundwater Remedy Implementation	January 1995	~~June~~August 1995
B/C Groundwater Remedy Operation	~~July~~September 1995	June 1996
B/C Groundwater Remedy Expansion	October 1996	?
B/C Data Gaps Analysis	July 1995	October 1996
D Zone Data Gaps Analysis	July 1995	October 1996
E Zone Data Gaps Analysis	July 1995	October 1996
Vadose Zone Remedy SOW	June 1995	September 1995
Vadose Zone Remedy Design	October 1995	March 1996
Vadose Zone Remedy Implementation	April 1996	September 1996
Vadose Zone Remedy Operation	October 1996	October 1998
Vadose Zone Remedy Expansion	October 1997	October 2000
Vadose Zone Data Gaps Analysis	October 1996	October 1998
Operation and Maintenance: Vadose Zone: B/C Zone: D and E Zone:	 October 1996 July 1995 Only if Needed	 To Completion To Completion Only if Needed

The time of operation of the groundwater extraction system is difficult to estimate and depends on the number of pore volumes needed to flush out the contamination. At the Davis Site, 10 pore volumes or more may be required to clean up the groundwater. ~~This~~ The ~~could correspond to groundwater extraction operation of 30 years or longer at the Davis Site.~~ actual time of operation will depend on site conditions. Estimates range from 20 to 140 years depending on final cleanup goals. However, the objective for this IROD is containment of the B and C zone contamination above MCLs. Final cleanup goals will be set forth in the ROD which is likely to be signed within 5 years.

The performance of the extraction system will be evaluated by estimating if groundwater within the ~~appropriate~~ MCL-based target ~~area~~ volume is captured horizontally and vertically. Water levels will be measured monthly in selected extraction and monitoring wells during the first quarter of operation of the groundwater extraction system to estimate the hydraulic gradients necessary to achieve capture of the contaminated groundwater plume. The specific monitoring requirements, in terms of frequency of measurements and wells from which measurements will be made, will be presented in the design documents for the groundwater remedial action. Horizontal groundwater capture will be evaluated by preparing contour maps of the groundwater elevation in the B, C, D, and E zones using all existing water level data. In addition, water levels at selected well pairs in the B, C, D, and E zones will be compared to determine if there is inward groundwater movement to the appropriate target area. Vertical groundwater capture from the E and D zones to the C zone

will be evaluated by preparing contour maps of the groundwater elevation in the C, D, and E zones. In addition, water levels at selected well pairs will be compared to determine if there is upward groundwater movement from the E and D zones to the C zone throughout the target area. Capture of the D and E contaminated groundwater component of this remedy will be monitored as part of gathering data for a later D/E zone decision. The D/E zone will be addressed in the final ROD.

Each of the extraction wells ~~should~~ will be sampled monthly during the first quarter of operation. A composite sample from all extraction wells ~~should~~ will also be collected if there is a centralized treatment facility rather than treatment at each wellhead. All samples ~~should~~ will be analyzed for VOCs by EPA Method 8010/8020 or equivalent. After the initial quarter, samples ~~should~~ will be collected quarterly and analyzed for VOCs. ~~It is assumed that~~ Influent water quality data will be collected to monitor possible changes in the target volume geometry and also to characterize the influent water stream that enters the groundwater treatment system.

Advanced UV oxidation was chosen as the groundwater treatment ~~system~~ method. The advanced UV oxidation system uses UV light in combination with an oxidant, such as hydrogen peroxide, to oxidize the contaminants in the groundwater. Advanced UV oxidation is a proven option that will work for the groundwater contaminants at the Davis Site. As a final treatment step, a granular-activated carbon treatment unit will be installed downstream of the UV oxidation unit. The carbon unit will function to "polish" the effluent as a safeguard against releasing contaminated water to the injection system. It is estimated that up to 2,000 pounds of carbon will be used each year during polishing. The spent carbon will be hauled offsite by the carbon vendor for regeneration. The contaminated groundwater will be treated to below detection limits for VOCs before being conveyed to the selected end use.

The extracted groundwater will be collected in manifold piping from the wellheads and routed to a centralized advanced UV oxidation treatment facility located near Extraction Well EW-3C (see Figure 2- ~~to 1~~ 11). Two groundwater end-use components have been developed to provide a beneficial use for the treated groundwater from the Davis Site: Wallace Farms irrigation and onsite groundwater injection. Detailed descriptions and evaluations of these components are presented in Appendix M(b) of the RI/FS. The end-use component evaluation presented in Appendix M(b) builds upon the original end-use analysis presented in the Intermediate Design Report for the Design Report for the Davis Site (CH2M HILL, 1993b).

The Wallace Farms irrigation and the onsite groundwater injection components will consist of a pipeline to convey water to the headworks of the irrigation system, a pipeline to the injection wells, two injection wells, telemetry, and automatic valving and controls. The groundwater end-use component is shown in Figure 2-~~11~~ -13. It is anticipated that Wallace Farms irrigation will only be used as a backup to injection. Preliminary injection testing indications are favorable for year-around injection of up to 400 gpm.

2.9.2 Description of Remedy for Soil

~~Soil vapor extraction will be used as a mechanism for collecting vadose zone contamination. An SVE system captures the VOCs in the vadose zone by applying a vacuum to the subsurface and inducing airflow through soils containing VOCs and collecting the contaminated soil gas through extraction wells.~~

An SVE system removes VOC contamination from the vadose zone. Airflow is induced through VOC-contaminated soil by applying a vacuum to extraction wells. VOC-contaminated soil vapor (or air) is pumped to the surface then passed through a granular activated carbon (GAC) unit to remove VOCs from the air. The treated air is then discharged to the atmosphere.

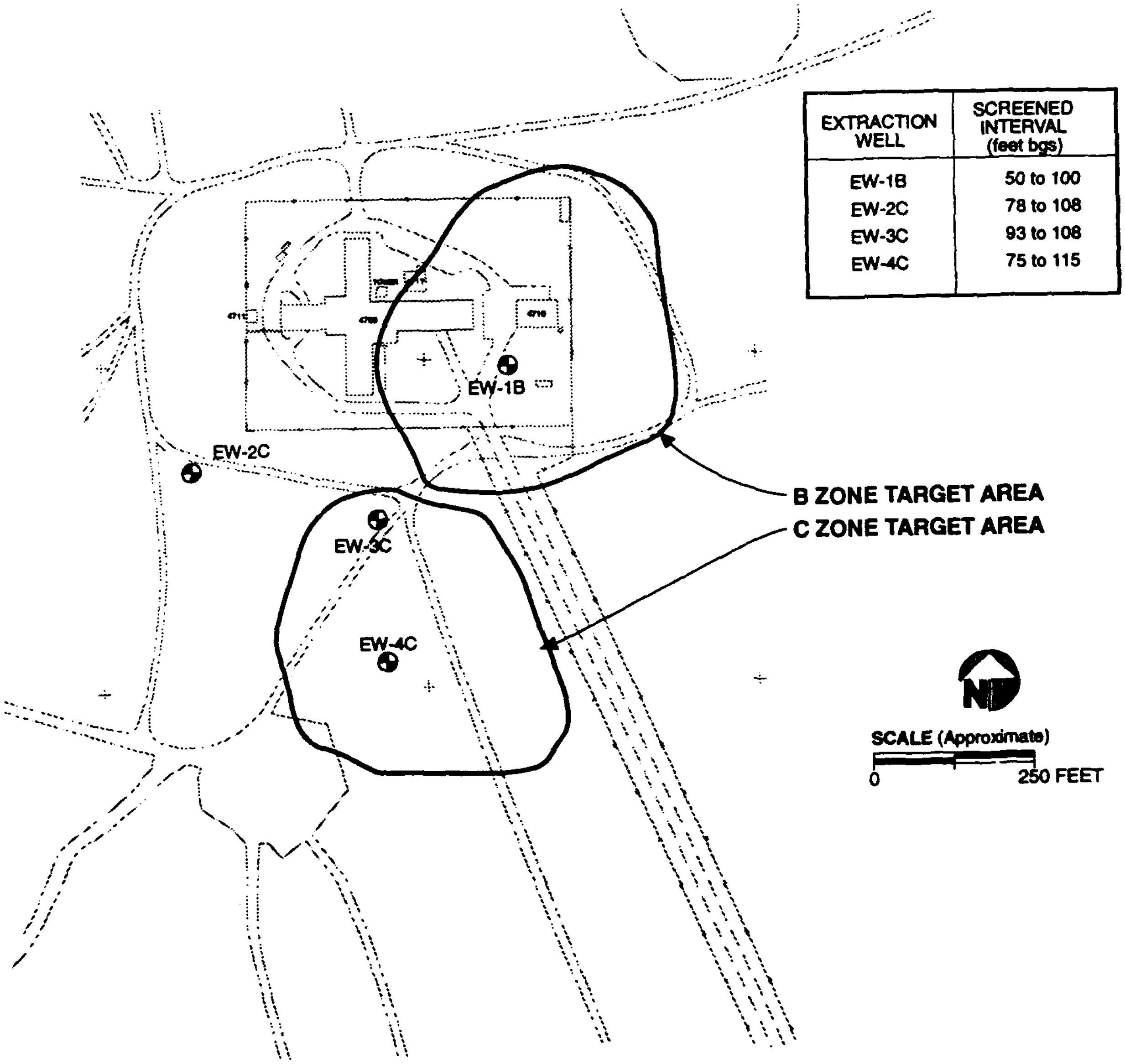
At the Davis Site, the estimated extent of VOC contamination is as shown on Figure 2-~~7~~8. The target zone boundary shown on Figure 2-~~7~~8 is based on soil gas data obtained down to depths of approximately 40 feet bgs. The SVE system discussed here only addresses contamination in the upper 40 feet of the subsurface.

The SVE modeling of the site indicates that capture of the vadose zone contamination can be achieved by applying a vacuum through existing SVMWs CH-1, CH-2, CH-4, and CH-5. Airflow rates of approximately 50 scfm are required at each well to provide capture. Figure 2-1~~2~~4 illustrates the extraction well layout. It is estimated to take 10 years of operation of the SVE system to remove ~~vadose zone~~ VOC *contamination* ~~down to below target levels~~ in the vadose zone to less than the cleanup goal of 500 ppbv.

~~Operation of the SVE system will develop a flow of clean air into the contaminated soil where the air will pick up contamination and exit through the extraction wells (see Figure 2-12). The continued replacement of contaminated pore air with uncontaminated air leads to the gradual decontamination of the soil.~~

A centralized offgas treatment facility will be installed at the Davis Site. Manifold piping will be used to collect ~~the offgas~~ VOC-contaminated air from the individual extraction wells and route it to a ~~granular activated carbon (~~GAC~~)~~ unit located to the east of Building 4710, as shown in Figure 2-1~~2~~3. The treated air would be discharged directly to the atmosphere.

Before being discharged, the airstream would be sampled and tested to make sure that it complies with air quality requirements. It is estimated that up to 3,000 pounds of carbon would be used annually for SVE treatment. The spent carbon will be hauled offsite by the carbon vendor for regeneration.



EXTRACTION WELL	SCREENED INTERVAL (feet bgs)
EW-1B	50 to 100
EW-2C	78 to 108
EW-3C	93 to 108
EW-4C	75 to 115

FIGURE 2-12
GROUNDWATER EXTRACTION WELL LOCATIONS
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

CH2M HILL

RDD1533_13

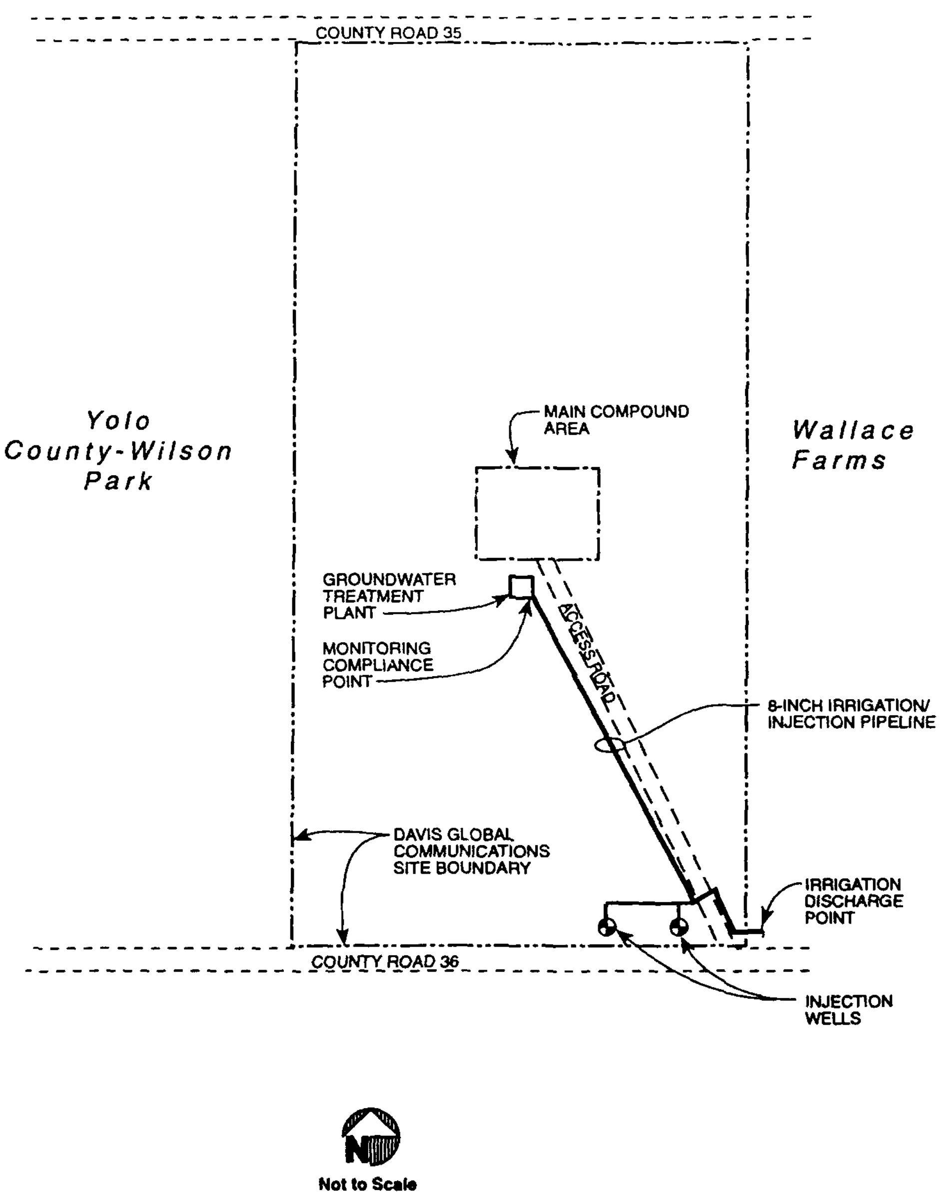


FIGURE 2-13
GROUNDWATER END USE COMPONENTS
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

RDD1533_12

CH2M HILL

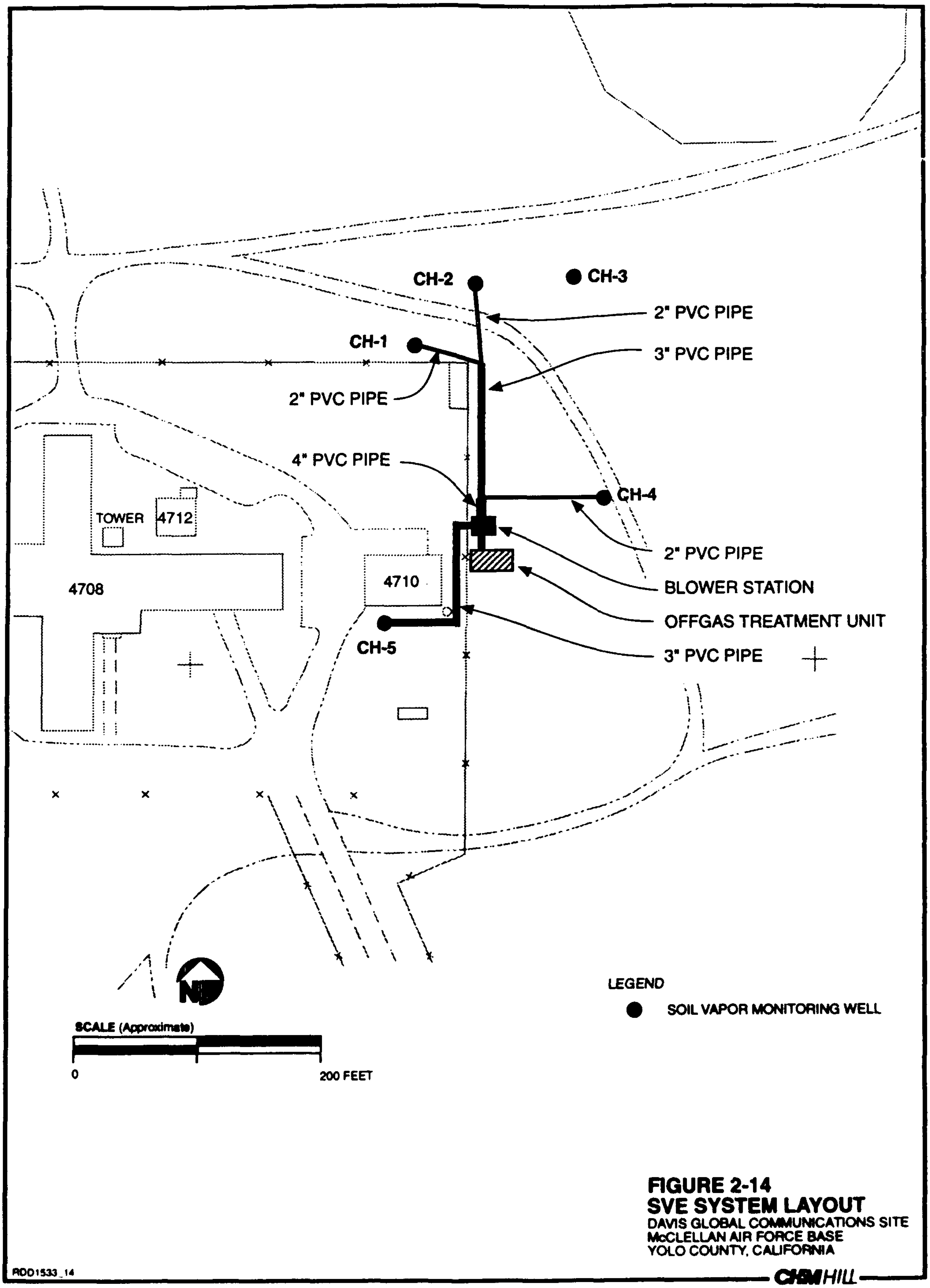


FIGURE 2-14
SVE SYSTEM LAYOUT
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

CH2MHILL

2.9.3 Estimated Costs for the Remed~~ies~~y

Estimated costs for implementation of Alternative 45 are shown in Table 2-1~~6~~7.

2.10 Statutory Determinations

The interim action satisfies the statutory requirements of Section 121 of CERCLA, as amended by SARA, in that the following mandates are attained:

- The interim action is protective of human health and the environment.
- The interim action complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action.
- The selected remedy is cost-effective.
- The selected remedy uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
- The selected remedy satisfies the preference for treatment that reduces toxicity, mobility, and/or volume as a principal element.

The following sections describe how the interim action satisfies each of the statutory requirements and the preference for treatment.

2.10.1 Protection of Human Health and the Environment

EPA guidance for the use of risk assessment in remedy selection (EPA, 1991b) states that:

> "...[g]enerally, where the baseline risk assessment indicates that a cumulative site risk to an individual using reasonable maximum exposure assumptions for either current or future land use exceeds the 10^{-4} lifetime excess cancer risk end of the risk range, action under CERCLA is generally warranted at the site. For sites where the cumulative site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}, action generally is not warranted, but may be warranted if a chemical specific standard that defines acceptable risk is violated or unless there are noncarcinogenic effects or an adverse environmental impact that warrants action. A risk manager may also decide that a lower level of risk to human health is unacceptable and that remedial action is warranted where, for example, there are uncertainties in the risk assessment results. *Records of Decision for remedial actions taken at sites posing risks within the 10^{-4} to 10^{-6} risk range must explain why remedial action is warranted.*"

Table 2-167
Cost for Alternative 45

Item	Cost Assumptions	Alternative 45 ~~Target Volume~~ ($)
GW Extraction Wells	No new wells are needed for ~~Target Zone 1. Five new wells are needed for Target Zone 2 (3 @ 200 ft. depth; 2 @ 240 ft depth). New wells are 6 inches in diameter with 20 to 30 ft. slotted screen interval. Installed using ARCH drilling method. Cost estimated @ $120.00/foot.~~ extraction.	0
~~Extraction Well Pipelines~~	~~Refer to Appendix M(b) for pipeline cost assumptions.~~	~~28,000~~
GW ~~Reinjection~~ Injection Wells	Wells are ~~8~~ 10 inches in diameter with ~~coated~~ mild steel casing and ~~slotted~~ stainless steel wire wrapped screen. Installed using ~~mud~~reverse-rotary drilling method. ~~Refer to Appendix M(b) for details.~~	126,000
~~Submersible Pumps~~	~~No 4 new pumps are needed. for Target Zone 1. Three new 7.5 hp pumps and two new 10 hp pumps are needed for Target Zone 2.~~	~~0~~ ~~7,000~~
GW Monitoring Wells	~~One~~ Four new monitoring wells ~~is~~ are needed ~~for Target Zone 2 only~~ (@ ~~240~~ 100 feet deep @ $100.00 per foot).	~~0~~ 40,000
End-Use System Pipelines	The pipelines that connect the treatment plant to the point of end use are 4,400 feet of pipe at $27 per foot. ~~for Target Zone 1 and 4,400 feet of pipe at $45 per foot for Target Zone 2.~~	119,000
~~GW Pump Station~~	~~Pump station costs are based on previous experience. See Appendix M(b) for details.~~	~~23,000~~
GW ~~Treatment~~Remediation System	The advanced UV oxidation system is designed to treat flow rates of 380 gpm. ~~for Target Zone 1 and 820 gpm for Target Zone 2~~. Costs are based on ~~vendor quotes~~contractor estimates. ~~See Appendix M(a) for detail.~~	~~290,000~~1,267,000
~~GW Discharge Structures~~	~~Discharge structure costs are based on previous experience. See Appendix M(b) for details.~~	~~10,000~~
~~Telemetry~~	~~Telemetry costs are based on previous experience. See Appendix M(b) for details.~~	~~40,000~~
Vapor Extraction Wells	No new vapor extraction wells are required.	0
Vapor Monitoring Wells	No new vapor monitoring wells are required.	0
Vapor Monitoring Wells	No new vapor monitoring wells are required.	0
Vacuum Blowers	Four new explosionproof 2-hp blowers are needed, with associated electrical controls and housing unit. Refer to Appendix I for detail.	21,000
Pipelines for the SVE System	Refer to Appendix I for pipeline cost details.	32,000
Offgas Treatment System	The GAC treatment unit is capable of treating 200 scfm of contaminated air. Cost is estimated @ $20,000. See Appendix L for details.	20,000

Table 2-167
Cost for Alternative 45

Item	Cost Assumptions	Alternative 45 ~~Target Volume~~ ($)
Subtotal		~~709,000~~ 1,625,000
Contractors Operational	5 percent of Construction Estimate	~~35,500~~ 81,250
Construction Cost Subtotal		~~744,500~~ 1,706,250
Bid Contingencies	10 percent of Construction Cost	~~74,400~~ 170,625
Total Construction		~~818,900~~ 1,876,875
Permitting and Legal	~~2~~ 1 percent of Total Construction	~~16,400~~ 18,769
Services During Construction	8.5 percent of Total Construction	~~69,600~~ 159,534
Total Implementation Cost		~~904,900~~ 2,055,178
Engineering Design Cost	15 percent of Total Implementation Cost	~~135,700~~ 308,277
Total Capital Cost		~~1,040,600~~ 2,363,455
Annual O&M		
GW Extraction System	See Appendix M(b), Table M(b)-10 for cost details	41,700
GW Reinjection System	See Appendix M(b), Table M(b)-10 for cost details	53,900
GW Irrigation System	See Appendix M(b), Table M(b)-10 for cost details	5,700
GW Treatment System	Costs are based on labor, power, lab analytical, health and safety, and maintenance contingency. See Appendix M(a) for detail.	~~251,000~~ 287,000
Vapor Extraction System	See Appendix I for cost details (20 to 30 percent for maintenance, $2,000 for power).	25,000
Offgas Treatment System	Estimate includes labor, materials, and power. See Appendix L for details.	21,500
Total O&M		~~398,800~~ 434,800
Capital Cost (1995 dollars)		~~1,148,000~~ 1,224,000
O&M Cost (1995 dollars)		~~440,000~~ 456,000

Note:

~~A carbon treatment unit may be required downstream of the groundwater treatment facility as a backup polishing unit. The costs associated with this unit have not been included in this cost analysis.~~ Costs are based on contractor's estimates. Actual costs may vary depending on site conditions.

The results of the risk assessment for the Davis Site indicated that increased lifetime cancer risks associated with contaminants in groundwater could exceed 10^{-4}, should groundwater be used as a residential or domestic water supply in the future. Risks to human health or the environment associated with contaminants in other media (soil and soil gas) do not warrant remedial action. Health risks associated with contaminants detected in the site production well fall within the 10^{-4} to 10^{-6} risk range. While these risks associated with contaminants in the production well would not warrant remedial action in accordance with EPA guidance, the RI/FS report has recommended further sampling from the production well to better define the source of contaminants detected in the well.

Currently, there are no pathways of exposure from groundwater under the site, because it is not used as a residential or domestic water supply. However, there are no prohibitions on such uses in the future. Therefore, action is warranted to reduce risks associated with contaminants in groundwater. The interim action proposed for the Davis site will protect public health by reducing risks in groundwater to the 10^{-6} to 10^{-4} risk range. On the basis of the results presented in Tables 2-~~7~~ 8, 2-~~8~~ 9, and 2-~~9~~ 10, risks in selected D and E zone wells could exceed 10^{-4}. However, implementation of the interim action will include additional monitoring of these wells to evaluate reductions in concentrations in these wells resulting from the interim action. If required, the interim action will be expanded to extract and treat contaminants in groundwater in the D and E zones.

2.10.2 Compliance with ARARs

The interim action will comply with all applicable, or relevant and appropriate chemical-, action-, and location-specific requirements (ARARs). The ARARs, and how they apply to specific portions of the selected remedy, are presented in Table 2-~~17~~-18. These ARARs are as presented below.

2.10.2.1 Action-Specific ARARs

State Water Resources Control Board Resolution 68-16. This resolution requires the continued maintenance of high quality water of the state. Unlike the federal antidegradation policy, this state policy includes groundwater as well as surface water. Water quality may not be allowed to be degraded below what is necessary to protect the "beneficial uses" of the water source. Beneficial uses of waters in the vicinity of the Davis Site are identified in the Water Quality Control Plan (Basin Plan) for the Central Valley Regional Water Quality Control Board (CVRWQCB). According to a policy letter recently issued by the State Regional Water Resources Control Board (SWRCB), compliance with Resolution No. 68-16 will result in cleanup levels ranging between background water quality and applicable water quality objectives specified in the Basin Plan, considering technical and economic obstacles to prompt compliance with objectives. The applicable water quality objectives for the contaminants detected in groundwater at the Davis Site are MCLs for this interim action.

Table 2-1~~7~~8
Compliance of Selected Remedy with ARARs

Requirement	Type	Description
Groundwater Extraction		
MCLs under the SDWA	ARAR	MCLs are limits on the concentrations in drinking water of substances potentially affecting human health. The selected remedy must achieve contaminant levels in groundwater at least as stringent as MCLs.
SWRCB Resolution No. 68-16 (Non-Degradation Policy)	ARAR	Requires continued maintenance of high quality waters in the State of California. Requires protection of beneficial uses of water. Provides a basis for cleanup levels that will not unreasonably affect the present and anticipated beneficial uses of water. Compliance with Resolution No. 68-16 will result in cleanup levels ranging between background and applicable water quality objectives (MCLs). Technical and economic factors may be considered in establishing measures for implementing cleanup.
~~SWRCB Resolution No. 92-49 (Policies and Procedures for Investigation, Cleanup and Abatement of Discharges)~~	~~ARAR~~*	~~Gives the RWQCBs oversight over the investigation and cleanup of pollutant discharges to water in California. Gives the RWQCBs the authority to make decisions regarding cleanup goals to protect beneficial uses of water. Incorporates Resolution No. 68-16 by reference.~~
EPA "Guidance for Evaluating the Technical Impracticability of Groundwater Restoration", OSWER Directive 9234.2-25	TBC	Provides guidance for determining when groundwater cleanup goals are technically achievable, and for establishing an alternative, protective cleanup strategy where restoration is determined to be technically impracticable.
Groundwater Treatment (UV-Oxidation)		
RCRA and HWCA Storage, Closure, Corrective Action, Treatment and other hazardous waste management regulations	ARAR	Hazardous wastes must be handled, stored and treated in a manner that complies with State and Federal hazardous waste management regulations.
YSAQMD Rule 3.4, New Source Review	ARAR	New sources require installation of BACT for emissions to the air. Risk assessment would be required to evaluate BACT for VOC emissions during treatment.
Groundwater End Use (~~Re~~Injection)		
SWRCB Resolution No. 68-16 (Non-Degradation Policy)	ARAR	Requires continued maintenance of high quality waters in the State of California. Requires protection of beneficial uses of water. Prohibits discharges to water that would result in degradation of water quality.

Table 2-1~~7~~8
Compliance of Selected Remedy with ARARs

Requirement	Type	Description
Soil Vapor Extraction and Offgas Treatment (Granulated Activated Carbon)		
~~SWRCB Resolution No. 92-49 (Policies and Procedures for Investigation, Cleanup and Abatement of Discharges)~~	~~ARAR~~*	~~Gives the RWQCBs oversight over the investigation and cleanup of pollutant discharges to water in California. Gives the RWQCBs the authority to make decisions regarding cleanup goals to protect beneficial uses of water. Incorporates Resolution No. 68-16 by reference.~~
RCRA and HWCA Storage, Closure, Corrective Action, Treatment and other hazardous waste management regulations	ARAR	Hazardous wastes must be handled, stored and treated in a manner that complies with State and Federal hazardous waste management regulations.
YSAQMD Rule 3.4, New Source Review	ARAR	New sources require installation of BACT for emissions to the air. Risk assessment would be required to evaluate BACT for VOC emissions during treatment.

Notes:
MCL - Maximum Contaminant Limit
SWDA - Safe Water Drinking Act
ARAR - Applicable or Relevant and Appropriate Requirements
TBC - To-be-Considered Criteria
SWRCB - State Water Resources Control Board
RWQCB - Regional Water Quality Control Board
EPA - U.S. Environmental Protection Agency
OSWER - Office of Solid Waste and Emergency Response
RCRA - Resource Conservation and Recovery Act
HWCA - Hazardous Waste Control Act (California)
YSAQMD - Yolo/Solano Air Quality Management District
BACT - Best Available Control Technology
VOC - Volatile Organic Compound

All components of the selected remedy will comply with the applicable Occupational Safety and Health Administration (OSHA) and California Division of Occupational Safety and Health (Cal-OSHA) requirements for protection of worker safety and health.

*Cleanup levels are not established in the IROD but will be established in the Final ROD.

If, after implementation of best practicable treatment or control measures, it is determined that it is not feasible to attain water quality objectives, the CVRWQCB may require ongoing monitoring to evaluate changes in water quality, implementation of a different technology for cleanup, or other abatement measures. The Regional Water Boards may also amend the Water Quality Control Plan to change a beneficial use if it can be justified under applicable requirements, such as State Water Board Resolution No. 88-63 ("Sources of Drinking Water Policy").

The selected remedial action alternative, which involves capture and extraction of groundwater contaminants in the A through C aquifers, does not specifically address contaminants, detected in the D zone in Monitoring Well MWD-3, that are associated with potentially significant increased lifetime cancer risks. However, the groundwater gradients created by the extraction system over time are expected to reduce these contaminant concentrations in the D aquifer. The selected remedial action alternative will include monitoring of water quality in Monitoring Well MWD-3 to evaluate the effectiveness of the groundwater extraction system in reducing contaminant concentrations in the D zone.

Hazardous Waste Management. The treatment technologies that will be used for ~~T~~the selected remedial action alternative will meet the applicable requirements of both RCRA as specified in Title 40 of the Code of Federal Regulations (CFR), Section 260 *et seq*., and California hazardous waste control regulations specified in Title 22 of the California Code of Regulations (CCR), Section 66001 *et seq*. These regulations address storage of hazardous wastes; closure of treatment, storage, and disposal facilities; hazardous waste treatment levels; and corrective action; and affect all components of the selected remedial action alternative.

Air Quality. Operation of the selected remedial action alternative will meet the requirements of the ~~Yolo Solano Air Pollution Control District (YSAPCD)~~ YSAQMD. ~~Best Available Control Technology (BACT) will be used for offgas treatment of VOCs removed from groundwater and hydrogen chloride (HCl), should it be formed as a treatment byproduct. Using BACT, emissions of VOCs to the air from the selected remedial action alternative are associated with worst case increased lifetime cancer risks of 4.4 x 10^{-6}. The YSAPCD has yet to select an acceptable risk level as a regulatory guideline, but is considering levels of either 1 x 10^{-6} or 1 x 10^{-5}. While VOCs emitted to the air could exceed the YSAPCD acceptable risk level under worst case conditions, a more reasonable, yet conservative, analysis of health risks would result in a significantly lower risk estimate (CH2M HILL, 1993).~~ Best Available Control Technology (BACT) will be used for treating VOCs emitted to the air from the SVE system. The VOC emissions to the air are not anticipated from the UV-oxidation treatment process for groundwater. The YSAQMD will identify conditions for operation of the SVE system to achieve the requirements of NSR, based on estimates of the emissions from the system. The BACT for the VOC emissions from the SVE system will be GAC treatment. The GAC treatment will achieve at least 90 percent control of VOC emissions to the air from the SVE system. A risk assessment will be performed during design of the SVE system to help identify operating conditions that meet the requirements of the YSAQMD.

Occupational Health and Safety. Operation of the selected remedial action alternative will meet applicable Occupational Safety and Health Administration (OSHA) requirements for protection of worker safety and health specified in 29 CFR 1910 *et seq.*, and California Division of Occupational Safety and Health (Cal-OSHA) requirements specified in 8 CCR 3202 *et seq.*

2.10.2.2 Chemical-Specific ARARs

The selected remedial action alternative will, at a minimum, reduce concentrations of each VOC detected in groundwater monitoring wells to MCLs. Achieving MCLs is a requirement under CERCLA, and MCLs are water quality objectives for groundwater under the Basin Plan.

2.10.2.3 Location-Specific ARARs

None.

2.10.2.4 Other Criteria, Advisories, or Guidance to be Considered for This Remedial Action

Vadose Zone Criteria. Chemical-specific ARARs are not available for VOCs in ~~soil~~ the vadose zone at the Davis Site. However, to-be-considered (TBC) criteria and experience with other sites at McClellan AFB indicate that concentrations of 500 ppbv or less in soil gas are not associated with significant contaminant transport from soil to groundwater. The selected remedial action alternative will, at a minimum, reduce the concentration of each VOC detected in soil gas to 500 ppbv.

2.10.3 Cost-Effectiveness

~~The selectedion remedial action ofa~~Alternative 5 for the interim remedial action ~~of groundwater treatment and SVE~~ is the ~~second highest~~ least costly alternative~~ less than the alternative of performing only~~ applying groundwater extraction. The selected remedial action alternative is ~~the most~~ protective of human health and the environment. ~~and achieves ARARs.~~ ~~Groundwater extraction alone may not achieve the objectives of SWRCB Resolution 68-16, because it does not prevent future degradation of groundwater resources. A cost savings is achieved by applying the selected remedial action alternative to Target Volume 1 (A through C vadose zone plus the B and C groundwater zones) where most of the groundwater contamination is present.~~

2.10.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

The selected remedial action alternative satisfies the statutory preference to use permanent solutions and treatment technologies to the maximum extent practicable by using UV

oxidation to destroy VOCs in groundwater and by treating the soil using SVE. There are no significant differences in implementability between the selected remedial action alternative and the other alternatives. The selected remedial action alternative potentially offers greater short-term effectiveness through the use of SVE to remove a source of future contamination to groundwater.

2.10.5 Preference for Treatment as a Principal Element

The selected remedial action alternative satisfies the statutory preference for treatment by using SVE for treatment of contaminants in soil and UV oxidation for destruction of VOCs extracted from groundwater.

2.11 Documentation of Significant Changes

The Proposed Plan for the Davis Site was released for public comment from May 6, 1994 to June 9, 1994. The selected remedy identified in the Proposed Plan concurs with the selected remedy presented in the IROD with the exception of the following:

1. The preferred alternative for treatment of the extracted soil vapor has changed from catalytic oxidation to granular activated carbon on the basis of re-evaluation of the treatment technologies, ~~and~~ recent soil vapor data~~.~~, and public comments. The primary reason for initially choosing catalytic oxidation over granular activated carbon was the presence of vinyl chloride and methane in CH-5. A bioventing study has been conducted in the vicinity of CH-5 and the results now indicate very low or nondetected concentrations of these constituents. Therefore, because granular activated carbon is less expensive to purchase and operate, is BACT-approved (except for vinyl chloride and methane), and is extremely reliable, it has been chosen over catalytic oxidation. Continued offgas monitoring will be performed to verify the appropriateness of ~~the~~ GAC treatment.

2. For the Feasibility Study, four alternatives were evaluated for site remedial action. The alternatives evaluated in the FS are shown in Table 2-19. Subsequent to the release of the Final RI/FS Report, McClellan AFB re-evaluated the selection of background target volumes for site remedial action. Specifically, McClellan AFB evaluated the effects of the remedial action on the time and cost of achieving IROD objectives while still meeting agency requirements and not significantly increasing risk levels. The evaluation resulted in the selection of a target volume that is based on MCLs instead of background levels. The evaluation that follows was performed to estimate the times and costs for achieving the IROD objectives for the background-based and MCL-based target volumes.

Time Comparison

The time required to remediate a contaminated aquifer [~~is dependent upon~~] depends on several variables. Contaminant type, initial concentration, remedial target concentration, and aquifer characteristics all affect time for remediation. The following equation was used to estimate concentration decay of a conservative constituent with time and subsequent time to remediate a contaminated aquifer.

$$C_i = C_o e^{-kt/Tpv}$$

where:

C_i	=	Influent Concentration
C_o	=	Initial Concentration
k	=	Leaching Efficiency
t	=	Time to Cleanup
Tpv	=	Time to Pump One Pore Volume

Calculations were performed to estimate the time required to remediate TCE contamination within the B and C zones at the Davis Site. Values for each of the parameters listed above were estimated for the Davis Site from data presented in the Final Davis RI/FS Report. The initial concentrations used are representative of TCE contamination levels detected in the B and C zones during July 1993. The leaching efficiency is a parameter that reflects the lithology through which the contaminants move. Porous materials such as sand have values of k between 0.5 and 0.6 (Drainage Principles and Applications, International Institute for Land Reclamation and Improvement, 1973).

The time to pump one pore volume was estimated from the groundwater flow modeling presented in Appendix J of the RI/FS Report. It was assumed that summer conditions would apply for 6 months and that winter conditions would apply for 6 months. Each zone was estimated independently of the other. For the B zone, the time to pump one pore volume varied from about 1.5 years (MCL target volume) to about 9.5 years (ND target volume). For the C zone, the time to pump one pore volume varied from about 0.4 year (MCL target volume) to 1.6 years (ND target volume).

The above equation was then used to estimate the concentration in the aquifer (C_i) over time for various combinations of the given parameters. An approximate time to remediate was then estimated by selecting a final remedial action concentration of 5.0 µg/l for TCE. The above equation estimates the time to cleanup for a conservative tracer. To apply this equation to a contaminant like TCE that interacts with the aquifer solids, the retardation factor for that contaminant must be considered. A retardation factor of 2 was assumed for TCE contamination. TCE concentrations from July 1993 were used as the initial concentration for the analysis.

The results of these time to cleanup calculations are summarized in Figures 2-15 and 2-16. The B zone concentration decay curve is shown in Figure 2-15. The MCL target volume is about one-third the size of the ND target volume in the B zone, see Table 2-19. The decay curves show that it takes about 20 years to reach the MCL goal when starting with the MCL target volume and about 140 years to reach the MCL goal when starting with the ND target volume.

The most critical factor in determining the time to reach the MCL influent level is the time required for flushing one pore volume from each target volume. With the background target volume, it is estimated to take 9.5 years to extract one pore volume of water from the contaminated aquifer. Even though the contaminant concentrations between the MCL target volume and the background target volume are below 5 µg/l, the volume of water for containment is defined by the background target volume which includes the additional volume between MCL and ND that is required to be controlled by pumping. The time of remedial action directly affects the costs associated with the remedial action. The following section will provide a comparison of the costs associated with each target volume.

The C zone concentration decay curve is shown in Figure 2-16. The MCL target volume is about one-half the size of the ND target volume in the C zone. The decay curves show that it takes about 6 years to reach the MCL goal when starting with the MCL target volume, and about 20 years to reach the MCL goal when starting with the ND target volume.

These results are presented only to estimate the time required to remediate the B and C zones at the Davis Site to an MCL level. The actual remediation time depends on many site-specific factors that are not accounted for in this simplified analysis. Biodegradation of contaminants, the presence of DNAPL, physical constraints on effective flushing such as low permeability, and the desorption kinetics of particular contaminants will influence the actual concentration decay behavior observed in the field. Because of this great degree of uncertainty, the actual progress of cleanup observed during remediation may be significantly different from the rates presented here.

Estimated Costs

A cost comparison based on the decay curves for each aquifer was performed. The estimated present worth costs for the No-Action Alternative (GSAP Program), the MCL-based target volume, and the ND-based target volume were calculated and are presented in Figure 2-17. The combined ND target volume for the B and C zones is three times larger than the MCL-based target volume. A 5 percent inflation rate was assumed along with the assumption that full replacement costs would be incurred at 20-year intervals. The GSAP alternative costs of $4.6 million represent the cost of the GSAP for a period of 140 years. The MCL costs of $8.0 million represent the present worth cost of an estimated 20-year cleanup time. The ND costs of $12.7 million represent the present worth cost of an estimated 140-year cleanup time.

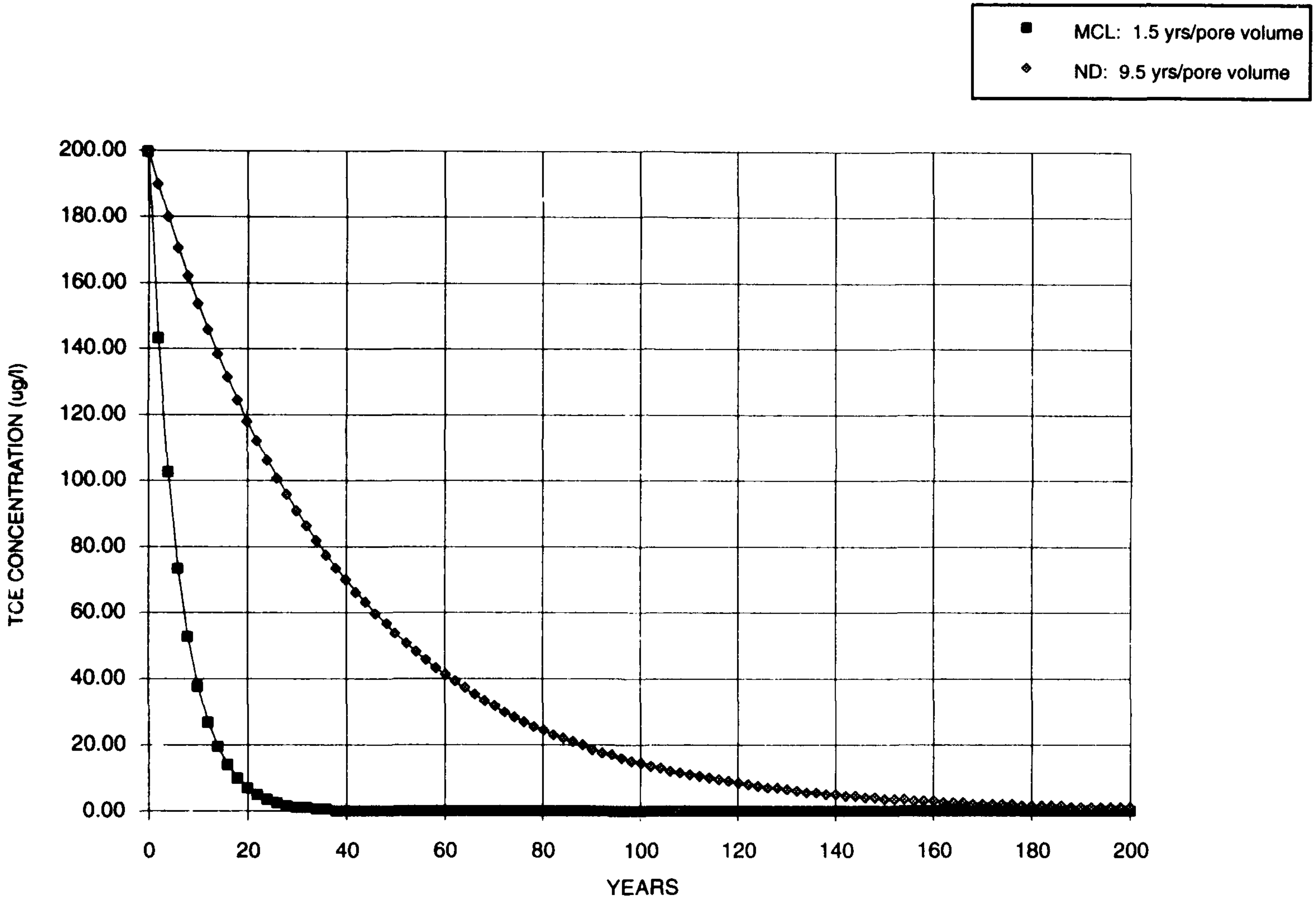


FIGURE 2-15
TCE CONCENTRATION DECAY FOR B ZONE
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

CH2M HILL

RDD1533_001

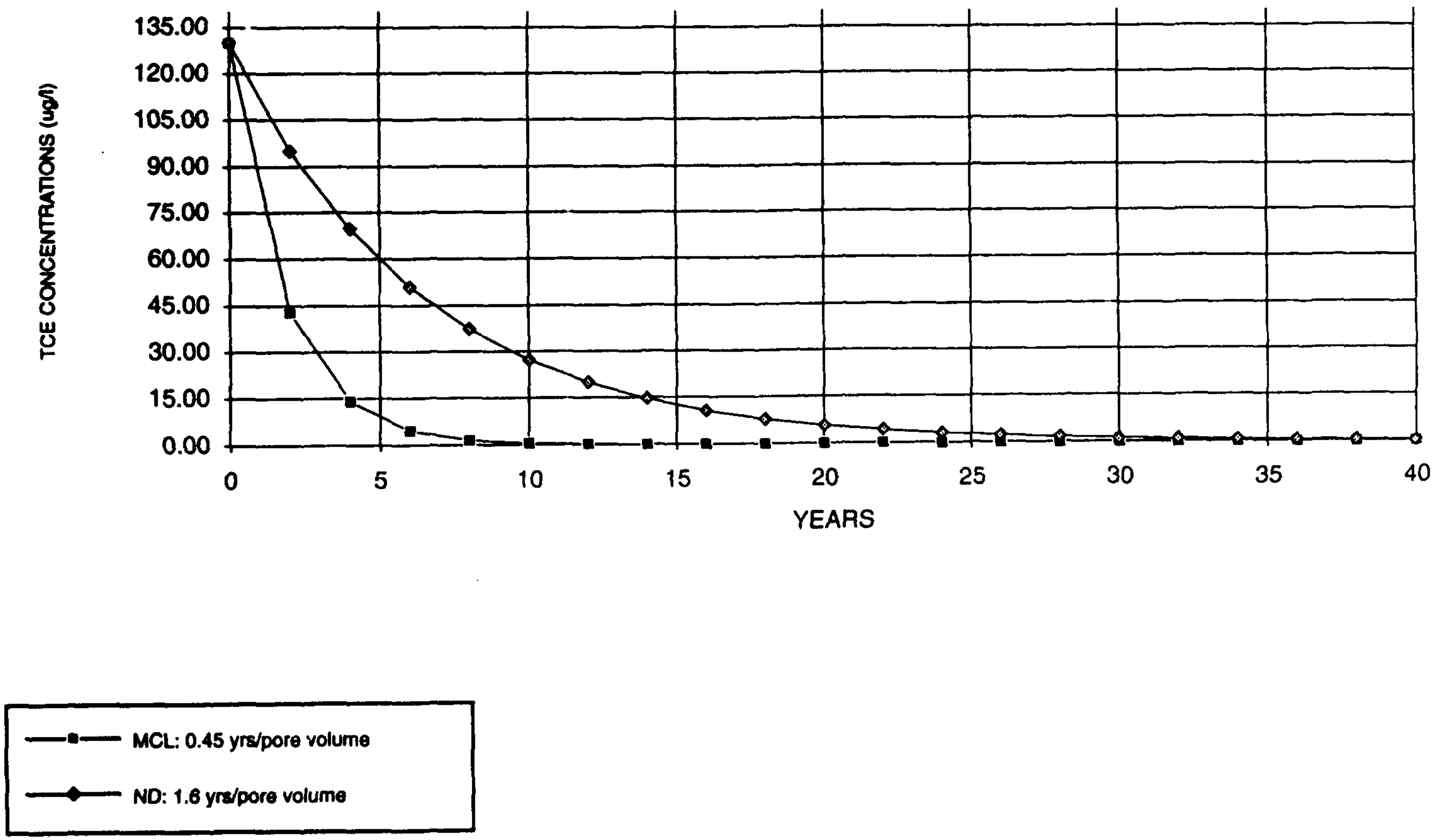


FIGURE 2-16
TCE CONCENTRATION DECAY FOR C ZONE
DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

CH2M HILL

RDD1533_002

Table 2-19
Comparison of Target Volumes[a]

Zone	MCL Target Volume[b] (gallons)	Background Target Volume (gallons)
B	19,300,000	40,700,000
C	13,100,000	56,800,000
D	33,400,000	76,100,000
E	None	74,600,000

[a]Based on July 1993 sampling results.
[b]Based on MCL of 5.0 μg/l for TCE.

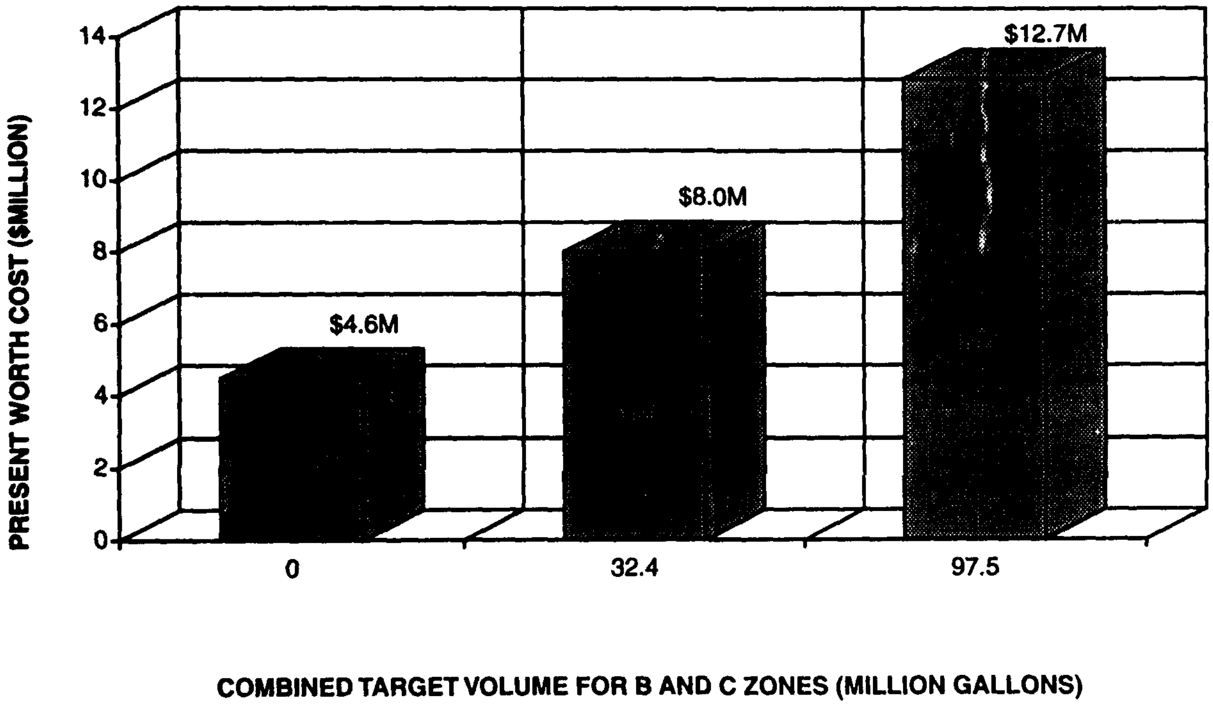


FIGURE 2-17
COST COMPARISON FOR NO ACTION VS MCL VS ND TARGET VOLUMES

DAVIS GLOBAL COMMUNICATIONS SITE
McCLELLAN AIR FORCE BASE
YOLO COUNTY, CALIFORNIA

CH2M HILL

RDD1533_003

Based on the cost evaluation presented above, a fifth alternative was developed for this IROD. Alternative 5 is the same as Alternative 4 from the FS, except that Alternative 5 target volumes are based on the volume of contaminated groundwater in the B and C zones above MCLs. Alternative 4 target volumes are based on contaminated groundwater above background levels in all zones.

Alternative 5 was chosen as the selected remedy for the IROD because it meets the objective of the IROD by containing groundwater contamination above MCLs in the B and C zones. Alternative 5 is also less costly than Alternatives 3 and 4. The difference in cost between the alternatives is primarily a function of the operation and maintenance costs. The O&M costs reflect on the times estimated for remedial action. The capital and O&M costs for each alternative were presented in Table 2-14.

3.0 Responsiveness Summary

3.1 Introduction

This section presents information about community preferences regarding the remedial alternatives and general public concerns about the Davis site. Opportunities for community involvement in the remedial action at the Davis site consisted of a public comment period on the site-related documents from May 6 to June 9, 1994. On May 19, 1994, a public meeting was held at Holmes Junior High School in Davis to present the McClellan AFB proposed cleanup plan for the site contamination. The meeting format consisted of a formal presentation by McClellan AFB, a formal public comment period, and an informal open house question-and-answer period. The proceedings of the meeting were recorded by a court reporter and the transcript became a part of the administrative record for the Davis site. Formal comments were received during the public comment period at the meeting and in writing during the public comment period. Responses to these comments are given below.

3.2 Oral Comments from the Public Meeting

Comment: *". . . wouldn't it be better to have the expedient [sic] of the best plan possible, the fastest way to get this cleaned up [sic]. Wouldn't that cost offset a slower process with the possibility of law suits, medical lawsuits in the future. . . ?"* (comment from Ms. Vicki Kelly)

Response: McClellan AFB believes that developing an **interim** record of decision addressing the most significant contamination (in the A through C zones), and using Alternative 4 5 provide the ~~fastest~~ best method for ~~cleanup of contaminated groundwater~~ meeting the objectives of this IROD. Alternative 4 5 results in containment of contaminated groundwater (above MCLs), which reduces the potential for exposures and health risks. Also, use of SVE reduces the estimated time to achieve cleanup from 200 to ~~3~~ 20 years.

Comment: *"What kind of underground storage tanks are those?" (comment from the Yolo-Solano County Air Pollution Control District)*

Response: Three underground storage tanks used to store diesel were located at the Davis site. These tanks were removed in 1988. The tanks were made of steel.

Comment: *"In your cleanup project . . . are you going to address the cleanup of diesel contamination?" (comment from Yolo-Solano County Air ~~Pollution Control~~ Quality Management District)*

Response: ~~Diesel contamination in soil is within the groundwater target volume defined for the IROD~~. If ~~this~~ diesel contamination migrates to groundwater, it will be extracted and treated along with the other groundwater contaminants. ~~While not a part of the IROD,~~ ~~d~~Diesel contamination in soil is currently being addressed in a treatability study using bioventing treatment. The results from the treatability study will determine whether the use of bioventing for continued diesel-contaminated soil treatment will be expanded or stopped. The results of the treatability study should be available by ~~September 1994~~ February 1995.

Comment: *"The project that your participation is about [sic] would make the target to cleanup [sic] the chlorinated problem and your cleanup technologies on soil vapor extraction and catalytic oxidation. You mentioned that these are proven technologies for chlorinated solvents. What is the percentage [sic] [removal efficiency]?" (comment from Yolo-Solano County Air ~~Pollution Control~~ Quality Management District)*

Response: ~~In the experience of McClellan AFB, SVE is a proven technology for removal of VOCs from soil. McClellan AFB has extensive experience with this technology, including experience at sites onbase. SVE is the remedy preferred by the U.S. Environmental Protection Agency for removal of VOCs in soil. While removal efficiencies will differ from site to site, according to differences between initial VOC concentrations and cleanup levels, McClellan AFB believes that SVE will attain the 500 ppbv concentration in soil gas discussed in Section 2.10.2.4.~~

~~McClellan AFB has reevaluated the selection of catalytic oxidation for offgas control of extracted soil vapors. Originally, the selection of catox was based on the presence of methane and vinyl chloride in soil gas; these two contaminants are poorly controlled by GAC offgas treatment. However, in reevaluating the available data, both methane and vinyl chloride concentrations were judged to be relatively low, and did not warrant selection of catalytic oxidation. The highest reported methane concentration of 1.5 percent in soil gas is less than the lower explosive limit (LEL) of 5 percent, and therefore is not likely to represent an explosive or flammability hazard in ambient air. Concentrations of methane below the LEL do not represent a health risk. The risk assessment showed that the highest increased lifetime cancer risk associated with the uncontrolled emission of vinyl chloride from soil was~~ ~~1.7×10^{-9}~~ ~~, which is well below a~~ ~~1×10^{-6}~~ ~~acceptable risk threshold. From these results, it is concluded that vinyl chloride emissions from GAC are not likely to pose a significant health risk. From these findings, it is concluded that GAC would be an appropriate control technology for SVE emissions.~~

Catalytic oxidation will not be used as a control technology for treating VOC contaminants in effluent from the SVE system. The Best Available Control

Technology for VOCs (i.e., chlorinated solvents) in SVE effluent is anticipated to be GAC. McClellan AFB anticipates the control efficiency of GAC for VOCs removed from the vadose zone by SVE to be at least 90 percent.

Comment: *An air permit may be required for the operation of the SVE system. (comment from Yolo-Solano Air ~~Pollution Control~~ Quality Management District)*

Response: The design, construction and operation of the SVE system will conform with all applicable local requirements, ~~however, under CERCLA, it is not necessary to obtain a permit for operation of the system~~. including the requirements for authorization to construct and a permit to operate from the YSAQMD.

Comment: *"Depending upon what the air emissions are you might have to do a further risk assessment to see what the cancer risk is." (comment from the Yolo-Solano Air ~~Pollution Control~~ Quality Management District)*

Response: ~~The risk assessment for the Davis site evaluated air emissions and concluded that they would pose no significant health risks, using conservative assumptions about emission rates, dispersion in air and durations of exposure. Dispersion of emissions from a stack operating for a shorter duration are not likely to result in higher risks than were calculated in the risk assessment.~~ A risk assessment will be performed to evaluate emissions of VOCs from the SVE system prior to the final design and construction of that system. It is anticipated that there will be no emissions associated with the groundwater treatment system (UV-oxidation).

Comment: *"What noise levels do you expect? Is there quite a bit of noise?"* (Comment from Mr. Bill Hartman)

Response: ~~Noise would be generated by the operation of the air blower for the SVE system and by the advanced oxidation unit for groundwater treatment. The advanced oxidation unit and SVE blower would be located approximately 200 feet from the main compound, and would produce noise levels that slightly exceed ambient and acceptable community noise levels **at the main compound**. Noise levels at areas where the public could be located would be indistinguishable from ambient background levels.~~ Noise levels will be controlled to levels compatible with the Yolo County General Plan noise policies. Noise levels from the SVE system and the UV-oxidation system should not be distinguishable from typical levels in public areas.

Comment: *What is the expected draw-down of the water table?"* (Comment from Mr. Bill Hartman)

Response: The drawdown of the water table caused by operation of the groundwater extraction system will vary seasonally. Localized drawdown within the extraction wells could vary 5 to 10 feet during the winter and 10 to 20 feet during the summer. ~~be up to 20 feet during summer and winter pumping conditions~~. However, groundwater modeling has shown that effective drawdown of the water table in the vicinity of the extraction wells is likely to be in the range of 5 to 10 feet. Groundwater extraction rates will vary across the site according to localized hydrogeologic conditions. When compared to the regional decline in water levels of up to 50 feet, the effect of pumping at the site on regional water levels is minimal.

Comment: *. . . will the farmers pay for the water, or is it available for other people to buy?"* (Comment from Mr. Bill Hartman)

Response: The primary proposed end use for the treated water will be onsite groundwater injection. Preliminary injection testing results were very favorable with regard to injection capacity onsite. Therefore~~, purveying water to~~ Wallace Farms ~~for~~ irrigation is considered an end use contingency should injection be temporarily interrupted. To date, no formal agreements are in place with Wallace Farms addressing the cost of water if it is made available for agricultural use. Making water available to other users is not ~~forseen~~ foreseen at this time.

Comment: *"Your Alternative No. 4, 30 years is not a very aggressive approach for remediation."* (Comment from Mr. Ron Gibson)

Response: Alternative 4, which includes SVE of VOCs in soil and groundwater extraction and treatment provides the most aggressive approach for cleanup~~.~~ of contamination to background levels. Alternative 5 provides the most aggressive approach for containment of contamination to MCLs in the B and C zones. Therefore, Alternative 5 fulfills the objectives of this IROD. Alternative 3, which consists only of groundwater extraction and treatment, is estimated to have a 200-year cleanup time.

Comment: *If you have any faith at all in your risk assessments, there is no danger to public health, so why not just apply Alternative No. 2? Your risk assessment says there is no immediate danger or expected danger to public health. Why go to the expense, or drag it out over 30 years for something that is not a danger?"* (Comment from Mr. Ron Gibson)

Response: Either of two facts can cause a remedial action: imminent and substantial threat to public health and the environment, or noncompliance with ARARs. Even if the threat is low, an action may be required on the basis of regulations. Alternative 2 was not selected because it does not address current groundwater contamination. While the risk assessment concludes that there are currently no significant health risks associated with the site,

contaminants have resulted in degradation of groundwater quality in excess of State of California requirements. Also, as discussed in the risk assessment, there could be exposure to significant health risks should an individual use groundwater under the site in the future.

Written Comments

Comment: *"I live directly across the street from this spill site and I am very concerned that the water in the well on our property might be contaminated. I would like to have someone come out to our well and test for contaminates, preferably a neutral party."* (Author of comment not identified)

Response: The investigation at the Davis site includes monitoring groundwater. The monitoring wells have identified the extent of contamination within site boundaries, and it is not likely that contaminants from the Davis site have migrated to the resident's well. The remedial action will involve containment of groundwater contamination to prevent future migration. Sampling of the resident's well for contamination associated with the Davis site will not be performed by McClellan AFB or a representative of McClellan AFB because there is no evidence of offsite groundwater contamination.

Comment: *"Why use catalytic oxidation? Why not use some other technology like GAC to treat soil gas? It's cheapter* [sic] *and proven."* (Author of comment not identified)

Response: As discussed in the response to comments from the Yolo-Solano Air ~~Pollution Control~~ Quality Management District, McClellan AFB has reconsidered the offgas treatment for SVE, and has concluded that GAC would be an appropriate offgas treatment.

4.0 Works Cited

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U.S. Environmental Protection Agency. 1989b. Risk Assessment Guidance for Superfund, Human Health Assessment, U.S. EPA Region IX Recommendation, 15 December 1989. (Interim Final).

Yolo County. 1983. ~~Residential Land Use~~ General Plan with Amendments.

5.0 Response to Comments

Department of Toxic Substances Control's Comments on the Draft Interim Record of Decision (IROD) - Davis Site

General Comments

1. **Please ensure that when "this" is used in the text, the item being referred to ("this") is clearly defined. Often times, it is clearer to simply refer to the subject "this" is referring to (i.e., replace "This zone...." with, The C zone....).**

Response:

The comment was noted and text changes were made accordingly.

2. **The Department's working copy of the IROD is included as an attachment to these comments. The Department's working copy has additional minor editorial comments not included in these formal comments. While the minor editorial comments identified in the IROD working copy do not have to be included in the draft final IROD, Department staff believe that the proposed editorial comments will clarify the draft final IROD.**

Response:

The comments on the Working Copy IROD were not made available for response.

3. **When discussing well depths or groundwater elevations, please use depth below ground surface.**

Response:

Depth below ground surface was used where applicable.

Primary Specific Comments

1. **Bullet 3. The Yolo/Solano Air Quality Management District (Y/S AQMD) must review the proposed air discharge and the discharge must meet Y/S AQMD requirements. Since McClellan AFB and the State regulators have not met with the Y/S AQMD and agreed on specific Y/S AQMD discharge requirements, the State cannot concur with discharge to the atmosphere after being treated by granulated activated carbon.**

Response:

The text was revised to read as follows:

The design, construction and operation of the SVE system will conform with all applicable local requirements, ~~however, under CERCLA, it is not necessary to obtain a permit for operation of the system~~. including the requirements for an authority to construct and a permit to operate from the YSAQMD.

2. **Bullet 4. Bullet 4 should discuss groundwater extraction (...four to six groundwater extraction wells...) An additional bullet should discuss the treatment system and injection.**

Response:

The text was revised to read as follows:

- **~~Groundwater~~ ~~e~~Extraction~~, treatment with ultraviolet (UV) oxidation, and end-use~~ of contaminated groundwater occurring within approximately 150 feet of the land surface beneath the site.** The groundwater ~~remedial action~~ extraction system will consist of four to six groundwater extraction wells pumping up to 400 gpm from the B and C zones.

- **Treatment of extracted groundwater with ultraviolet (UV) oxidation.** The extracted groundwater will be conveyed to a groundwater treatment system consisting of an advanced UV oxidation treatment unit followed by a carbon polishing treatment unit.

- **End use of treated groundwater.** The treated groundwater will be conveyed to one of two injection wells where it will be injected into the E zone and lower groundwater.

- Groundwater contamination above ~~detection limits~~ (MCLs) will be ~~targeted~~ addressed in this interim remedy.

3. **Bullet 4. The existing bullet, "Using interim action treatment...." should be a paragraph. Bullet 4 should state, "Consistent with anticipated final remedy". An additional bullet (five) should state that the interim remedy reduces toxicity, mobility and volume.**

Response:

The text was revised to read as follows:

Although this interim action is not intended to fully address the statutory mandate for permanance and treatment to the maximum extent practicable, this interim action uses treatment and furthers that statutory mandate. An additional bullet is not needed based on discussions during the September 1, 1994, meeting.

4. **Last Pgph. Delete first sentence. Add a sentence declaring that this IROD does not establish clean-up levels. Recommend that the sentence that starts, "Because this remedy..." be rewritten; The interim remedial actions will be reviewed within five years to ensure adequate protection of human health and the environment. Last sentence, recommendation; The U.S. Air force, McClellan AFB, in cooperation with the California EPA, will continue to oversee interim remedial activities to develop the final remedial alternatives for the Davis Site.**

Response:

The text was revised to read as follows:

Although this interim action is not intended to fully address the statutory mandate for permanance and treatment to the maximum extent practicable, this interim action uses treatment consistent with the final anticipated remedy and furthers that statutory mandate. Because this action does not constitute the final remedy for the Davis Site, the statutory preference for remedies that employ treatment to reduce toxicity, mobility, or volume as a prinicpal element, although partially addressed in this remedy, will be addressed by the final response action. Following implementation of this interim action, McClellan AFB, in cooperation with the California Environmental Protection Agency (Cal-EPA) will re-assess conditions at the Davis Site to identify the need for further actions to protect human health and the environment. Remedial action goals have been developed for this interim action based on Federal and State requirements. The remedial action goals that have been developed for this interim action are to protect the present and anticipated beneficial uses of groundwater. As implied in the definition of the interim action, these remedial action goals are non-binding, and the technical and economic feasibility of achieving these goals will be reevaluated by McClellan AFB, in cooperation with Cal-EPA, before implementation of the final response action. This interim action will be reviewed within 5 years to ensure adequate protection of human health and the environment. Within 5 years, McClellan AFB, in cooperation with Cal-EPA, will develop final remedial action goals and final remedial action alternatives for the Davis Site.

Sacramento Air Logistics Center
Vice Commander

Date

Anthony J. Landis, P.E.
California Environmental Protection Agency
Department of Toxic Substances Control
Chief of Operations
Office of Military Facilities

Date

William H. Crooks
California Environmental Protection Agency
Central Valley Regional Water Quality Control Board
Executive Office

Date

~~Note: Signatures to be identified by Draft Final IROD.~~

5. **Signature block DTSC:**
Anthony J. Landis, P.E.
Chief of Operations
Office of Military Facilities

Response:

See response to Comment 4.

6. **"Soil gas concentrations for PCE in "this" range..." "range" has not been previously defined, therefore "this range" has no meaning. Pgph 1 text specifies a concentration of 100 ppbv for PCE as causing an impact to groundwater while Section 2.10.2.4 specifies a minimum reduction to 500 ppbv. A consistent number should be used.**

Response:

The text was revised to read as follows:

According to RWQCB, soil gas concentrations of less than 500 ppbv for PCE are no longer considered a continuing source of groundwater contamination. ~~Soil gas concentrations for PCE in this range are approximately 100 ppbv~~ (Alex MacDonald, personal communication, September 1, 1994).

7. **The Department recommends that a Table presenting ranges of contaminant (COCs) concentrations for each zone be included in section 2.5.1.**

Response:

The text was revised to read as follows:

See Table 2-6 attached.

8. **Pgph 2. At previous project manager meetings, the RPMs agreed to change the designation of MWD-2 to MWC-2 so the well designation accurately reflects the screen depth.**

Response:

The text was revised to read as follows:

Extraction Well EW-1C and Monitoring Well ~~MWD-2~~ MWC-2 are the only wells completed in the C zone within the fenced compound area. The coarse-grained materials within the C zone become more permeable with depth according to well development testing. Most of the permeable units within the C zone above 115 feet bgs are composed of silty sand. The units below 120 feet thicken and are typically composed of sand and gravel with sand. The permeable unit between approximately 120 feet and 145 feet bgs, bounded by Monitoring Well ~~MWD-2~~ MWC-2 on the northeast and Monitoring Well MWD-10 on the southwest, appears to be continuous within this range. This zone has the potential to be a conduit for downward contaminant movement beneath the site by linking the C and D zones near Well Cluster MW3.

9. **Pgph. 2. First sentence. Recommend changing "variable" to "change seasonally." The Department recommends that a series of maps showing the seasonal variability of groundwater flow directions for each aquifer (B, C and D) be included in Section 2.5.3. In reading the last sentence in the first paragraph, it is unclear what point is trying to be made. (Operation of the agricultural wells nearest the site will influence ground water flow toward the agricultural well?).**

Response:

Noted change was made on p. 2-20. Figures 2-6a through 2-6c have been added.

The horizontal gradients for the B, C, and D zones for the period from July 1992 through July 1993 are shown in Figures 2-6a through 2-6c. It is likely that agricultural pumping south and east of the site influences D zone groundwater flow directions.

Table 2-6
Range of Contaminant Concentrations Found in Groundwater
July 1992 through July 1993

Parameter Name	Minimum Detected Value (µg/l)	Maximum Detected Value (µg/l)	Well Name	Date of Maximum Detect
B Zone				
1,1-Dichloroethane	1.7	4.66	MW-7	07/09/93
1,1-Dichloroethylene	1	114	MW-3	07/09/93
Benzene	0.3	7.48	MW-2	07/09/93
cis-1,2-Dichloroethylene	.339	410	MW-3	02/01/93
Tetrachloroethylene	.120	464	MW-5	07/09/93
trans-1,2-Dichloroethylene	1.3	1.7	MWB-14	07/30/92
Trichloroethylene	.222	570	MW-3	08/03/92
Vinyl chloride	2.3	86.3	MW-1	07/09/93
C Zone				
1,1-Dichloroethane	4.68	802	MWC-3	07/07/93
1,1-Dichloroethylene	ND	ND	–	–
Benzene	ND	ND	–	–
cis-1,2-Dichloroethylene	.39	1.6	MWC-14	08/03/92
Tetrachloroethylene	.25	57	MWC-3	10/30/92
trans-1,2-Dichloroethylene	ND	ND	–	–
Trichloroethylene	.32	34	MWC-3	04/28/93
Vinyl chloride	ND	ND	–	–

Table 2-6
Range of Contaminant Concentrations Found in Groundwater
July 1992 through July 1993

Parameter Name	Minimum Detected Value (µg/l)	Maximum Detected Value (µg/l)	Well Name	Date of Maximum Detect
Zone D				
1,1-Dichloroethane	ND	ND	–	–
1,1-Dichloroethene	.85	35.4	MWD-10	07/08/93
Benzene	ND	ND	–	–
cis-1,2-Dichloroethylene	.32	2.74	MWD-3	07/07/93
Tetrachloroethylene	.166	67.6	MWD-3	07/07/93
trans-1,2-Dichloroethylene	ND	ND	–	–
Trichloroethylene	.233	46.7	MWD-3	07/07/93
Vinyl Chloride	ND	ND	–	–
Zone E				
1,1-Dichloroethane	ND	ND		
1,1-Dichloroethene	.37	6.12	MWE-12	07/14/93
Benzene	ND	ND	–	–
cis-1,2-Dichloroethylene	.37	.37	MWE-21	07/14/93
Tetrachloroethylene	.195	1.19	MWE-3	07/06/93
trans-1,2-Dichloroethylene	ND	ND	–	–
Trichloroethyle				

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10. **Pgph 3. Vertical gradients for the B zone should also be discussed and included in Figure 2-6.**

Response:

The text was revised to read as follows:

Groundwater levels for the B zone are nearly identical with those from the C zone. Therefore, vertical gradients between the B zone and lower zones are the same as those shown in Figure 2-7 for the C zone and lower zones.

11. **Table 2-11. The Table is missing the soil gas section.**

Response:

The revised table is attached:

Table 2-1~~1~~2
Treatment and End-Use Options Evaluated for Soil Vapor and Groundwater Contamination

Contaminated Media	Treatment Methods	Treatment Method Selected	End-Use Options Evaluated	End-Use Option Selected
Groundwater	UV Oxidation/Granular Activated Carbon Polish	✓	Wilson Park Irrigation	
	Granular Activated Carbon		Wallace Farms Irrigation	✓
	Air Stripping		Surface Water Discharge to Putah Creek	✓
			Onsite Groundwater Injection	✓
			Onsite Irrigation	
Soil Vapor	Catalytic Oxidation		Not Applicable	Vented to Atmosphere
	Purus Padre			
	Electron Beam Technology			
	Granular Activated Carbon	✓		

12. **Include costs for Alternative 1 - No Action (estimate monitoring costs)**

Response:

The revised table includes monitoring costs.

Table 2-1~~3~~4 Estimated Capital, Operating, and Present Worth Costs for Alternatives			
Alternative	**Capital Cost ($)**	**Annual O&M ($)**	**Total Present Worth Costs ($)**
1	0	230,000	4,600,000
2	194,000	~~59,000~~ 289,000	~~600,000~~ 2,400,000
3	TV1: ~~1,030,000~~2,002,000 TV2: ~~1,767,000~~3,459,000	TV1: 388,000 TV2: 576,000	TV1: ~~14,300,000~~10,900,000 TV2: ~~23,900,000~~17,000,000
4	TV1: ~~1,224,000~~2,363,000 TV2: ~~1,961,000~~3,839,000	TV1: 447.000 TV2: 635,000	TV1: ~~7,000,000~~ 12,700,000 TV2: ~~10,200,000~~ 18,800,000
5	2,363,000	456,000	8,000,000

13. First sentence should read; Cal-EPA supports installation and operation of the SVE and treatment system and implementation of a groundwater extraction and treatment system at the Davis site. Remedial goals...."

Response:

The text was revised to read as follows:

Noted change made, page 2-52, paragraph 5 (last paragraph)

14. State that there was no objection by the community to implementing the proposed action.

Response:

The text was revised to read as follows:

Community concerns raised about the different alternatives are discussed below:

- Comments were raised as to whether the fastest method for cleanup was being applied at the Davis Site. McClellan AFB responded that developing an interim remedy and using Alternative 4 provided the fastest cleanup.

- One comment was raised as to the need for remedial action beyond SVE (groundwater extraction that will be used in Alternatives 3 and 4) if the risk assessment predicted no current exposures to contaminants in groundwater. McClellan AFB responded that SVE (Alternative 2) did not meet several of the other evaluation criteria used for selecting remedial action alternatives.

- Comments were raised about the control efficiency of offgas treatment for the SVE system, health risks associated with VOC emissions, and noise levels, from the SVE system (that will be used

in Alternatives 2 and 4). McClellan AFB provided added information on the control efficiency and expected noise levels, and stated that a health risk assessment will be performed prior to operation of the SVE system to evaluate health risks associated with VOC emissions. The design of the SVE system also will be reviwed by the Yolo/Solano Air Quality Management District (YSAQMD) prior to its construction.

- A comment was raised about the expected draw-down of the water table associated with operation of the groundwater extraction system (that will be used in Alternatives 3 and 4). McClellan provided a comparison of the draw-down from operation of the groundwater extraction system with the existing regional decline in the water table.

- A comment was raised about the availability of treated water produced from the groundwater extraction system (that will be used in Alternatives 3 and 4). McClellan AFB responded that the water will be reinjected into the aquifer, and that irrigation is only a temporary, emergency use should reinjection be interrupted.

15. Either specify the range of hydraulic gradients (horizontal or vertical) that will be used to confirm capture, or refer to the fact that specifics to determine capture will be presented in the operations manual.

Response:

The text was revised to read as follows:

Water levels will be measured monthly in selected extraction and monitoring wells during the first quarter of operation of the groundwater extraction system to estimate the hydraulic gradients necessary to achieve capture of the contaminated groundwater plume. The specific monitoring requirements, in terms of frequency of measurements and wells from which measurements will be made, will be presented in the design documents for the groundwater remedial action.

16. Add, Description of Remedy for Contaminated Soil. Pgph 1. Edit. An SVE system removes VOCs in the vadose zone....and inducing airflow through VOC contaminated soil. Pgph 4. Delete the first two sentences. Specify what the term "target levels" means.

Response:

The text was revised to read as follows:

An SVE system removes VOC contamination from the vadose zone. Airflow is induced through VOC-contaminated soil by applying a vacuum to extraction wells.

VOC-contaminated soil vapor (or air) is then pumped through the extraction wells to the surface then passed through a granular activated carbon (GAC) unit to remove VOCs from the air. The treated air is then discharged to the atmosphere.

At the Davis Site, the estimated extent of VOC contamination is as shown on Figure 2-~~7~~8. The target zone boundary shown on Figure 2-~~7~~8 is based on soil gas data obtained down to depths of approximately 40 feet bgs. The SVE system discussed here only addresses contamination in the upper 40 feet of the subsurface. The SVE modeling of the site indicates that capture of the vadose zone contamination can be achieved by applying a vacuum through existing SVMWs CH-1, CH-2, CH-4, and CH-5. Airflow rates of approximately 50 scfm are required at each well to provide capture. Figure 2-1~~2~~3 illustrates the extraction well layout. It is estimated to take 10 years of operation of the SVE system to remove ~~vadose zone~~ VOC contamination ~~down to below target levels~~ in the vadose zone to less than the cleanup goal of 500 ppbv.

17. Air Quality. reference should be made to the Yolo/Solano Air Quality Management District, not APCD.

Response:

Noted change made page 2-64.

18. *See Primary Specific Comment #6.*

Response:

See response to Primary Specific Comment 6.

19. Comment on percentage removal efficiency. Add a short paragraph on Destruction Removal Efficiencies (DREs) and the DREs for cat-ox and GAC systems. In the response, a statement is made that "....vinyl chloride concentrations were judged to be relatively low, and did not warrant selection of catalytic oxidation." Specify who made the judgement regarding vinyl chloride concentrations. The Yolo/Solano AQMD should be making the decision on emissions and operating conditions of the off-gas treatment systems.

Response:

The text was revised to read as follows:

Comment: *"The project that your participation is about would make the target to cleanup the chlorinated problem and your cleanup technologies on soil vapor extraction and catalytic oxidation. You mentioned that these are proven technologies for chlorinated solvents. What is the*

percentage [removal efficiency]?" (comment from Yolo-Solano County Air ~~Pollution Control~~ Quality Management District)

Response: ~~In the experience of McClellan AFB, SVE is a proven technology for removal of VOCs from soil. McClellan AFB has extensive experience with this technology, including experience at sites onbase. SVE is the remedy preferred by the U.S. Environmental Protection Agency for removal of VOCs in soil. While removal efficiencies will differ from site to site, according to differences between initial VOC concentrations and cleanup levels, McClellan AFB believes that SVE will attain the 500 ppbv concentration in soil gas discussed in Section 2.10.2.4.~~

~~McClellan AFB has reevaluated the selection of catalytic oxidation for offgas control of extracted soil vapors. Originally, the selection of catox was based on the presence of methane and vinyl chloride in soil gas; these two contaminants are poorly controlled by GAC offgas treatment. However, in reevaluating the available data, both methane and vinyl chloride concentrations were judged to be relatively low, and did not warrant selection of catalytic oxidation. The highest reported methane concentration of 1.5 percent in soil gas is less than the lower explosive limit (LEL) of 5 percent, and therefore is not likely to represent an explosive or flammability hazard in ambient air. Concentrations of methane below the LEL do not represent a health risk. The risk assessment showed that the highest increased lifetime cancer risk associated with the uncontrolled emission of vinyl chloride from soil was~~ $\cancel{1.7 \times 10^{-9}}$~~, which is well below a~~ $\cancel{1 \times 10^{-6}}$ ~~acceptable risk threshold. From these results, it is concluded that vinyl chloride emissions from GAC are not likely to pose a significant health risk. From these findings, it is concluded that GAC would be an appropriate control technology for SVE emissions.~~

Catalytic oxidation will not be used as a control technology for treating VOC contaminants in effluent from the SVE system. The BACT for VOCs (i.e., chlorinated solvents) in SVE effluent is anticipated to be GAC. McClellan AFB anticipates the control efficiency of GAC for VOCs removed from the vadose zone by SVE to be at least 90 percent.

Comment: *An air permit may be required for the operation of the SVE system. (comment from Yolo-Solano Air ~~Pollution Control~~ Quality Management District)*

Response: The design, construction and operation of the SVE system will conform with all applicable local requirements, ~~however, under CERCLA, it is not necessary to obtain a permit for operation of the~~

~~system~~. including the requirements for an authority to construct and a permit to operate from the YSAQMD.

Comment: *"Depending upon what the air emissions are you might have to do a further risk assessment to see what the cancer risk is." (comment from the Yolo-Solano Air ~~Pollution Control~~ Quality Management District)*

20. Comment on noise levels. The statement is made that "The...SVE blower...would produce noise levels that slightly exceed ambient and acceptable community noise levels (sic) at the main compound. Ambient noise levels should be measured and reported as part of pre-startup. Based on experience at OU-D at McClellan AFB, and given the rural location of the Davis site, it is difficult to believe that noise levels will only "slightly exceed" ambient conditions and acceptable community noise levels. McClellan AFB should have contingencies (operational periods, installation of mufflers, etc.) to address noise related issues.

Response:

The text was revised to read as follows:

Comment: *"What noise levels do you expect? Is there quite a bit of noise?"*

Response: ~~Noise would be generated by the operation of the air blower for the SVE system and by the advanced oxidation unit for groundwater treatment. The advanced oxidation unit and SVE blower would be located approximately 200 feet from the main compound, and would produce noise levels that slightly exceed ambient and acceptable community noise levels **at the main compound**. Noise levels at areas where the public could be located would be indistinguishable from ambient background levels.~~ Noise levels will be controlled to levels compatible with the Yolo County General Plan noise policies. Noise levels associated with operation of the SVE system and the UV-oxidation system are not anticipated to be distinguishable from ambient background levels in areas where the public could be located.

Secondary Specific Comments

1. Fig. 2-1. The site map should show proximity to the "local" community, not to a golf course.

Response:

Noted change made to Figure 2-1.

2. **Pgph 2. Use depths below ground surface. Specify that "The wells..." are agricultural wells are typically...**

Response:

The text was revised to read as follows:

The agricultural wells are typically 200 to 500 feet deep.

3. **Pgph 4. last sentence. Most agricultural wells are also screened above the D zone. Department staff speculate that most production is from the "D" and lower zones.**

Response:

The text was revised to read as follows:

Most agricultural wells are screened ~~in~~ across the D and deeper zones.

4. **Last sentence on page. "...based on information contained in the Administrative Record."**

Response:

Noted change made, page 2-13.

5. **Pgph 3. "Contaminants in "this" region...." Define "this" region.**

Response:

The text was revised to read as follows:

Contaminants in the fine-grained ~~this~~ region between 40 and 70 feet bgs are mobilized each winter as water levels rise, saturating the available pore spaces and dissolving residual contaminants sorbed to the soil.

6. **Last sentence. Specify if "This area..." is referring to the area bounded by MWC-3 and MWD-3 or if the reference is to the D zone in general.**

Response:

Noted change made on page 2-16.

7. **First sentence. "...are screened within this zone." Specify the D zone.**

Response:

Noted change made on page 2-19.

8. **First bullet. Edit "...do not represent a significant human health risk,..."**

Response:

The text was revised to read as follows:

- Direct contact exposures (soil ingestion and skin contact with soil) to petroleum hydrocarbon contaminants in soil do not represent ~~a~~ significant human health or ecological health risks, and require no further action.

9. **First Pgph. Sentence that starts "Most of the groundwater contamination..." should begin a new paragraph. Second Pgph. Add "Estimated human health risks...". Specify that "It is anticipated that residual contaminants will remain in the D and E zones with implementation of the interim remedial action. However, it is not known..."**

Response:

Noted changes made on page 2-30.

10. **The Department staff recommends a separate paragraph for each alternative, for each subsection (2.8.1 - 2.8.7.).**

Response:

Noted change made, pp. 2-48 through 2-50.

11. **Add, Description of Remedy for Contaminated Groundwater. Edit "...to capture and remove contaminated groundwater from..." Delete reference to A zone for water targeted for capture. Delete the sentence "Over 80 percent of the ...." Add a sentence specifying the capture limits.**

Response:

Changes made on page 2-53.

12. **Last sentence. Target Zone 1 should be the B and C aquifers and the A zone.**

Response:

This section was changed because of the addition of Alternative 5. Therefore, this comment no longer applies.

Regional Water Quality Control Board's Comments on the Draft Copy, Interim Record of Decision Davis Global Communications Site, McClellan Air Force Base

1. **Pgph. 1. This paragraph contains a discussion on ground water elevation monitoring to determine effectiveness of the extraction system. Some additional specific language on criteria to be used for determining acceptable hydraulic control should be supplied. In addition, there should be some discussion on adjustment of pumping based on the results of the monitoring.**

Response:

The text was revised to read as follows:

The performance of the extraction system will be evaluated by estimating if groundwater within the ~~appropriate~~ MCL-based target ~~area~~ volume is captured horizontally and vertically. Water levels will be measured monthly in selected extraction and monitoring wells during the first quarter of operation of the groundwater extraction system to estimate the hydraulic gradients necessary to achieve capture of the contaminated groundwater plume. The specific monitoring requirements, in terms of frequency of measurements and wells from which measurements will be made, will be presented in the design documents for the groundwater remedial action.

2. **Table 2-16. Change "reinjection" to "injection" on item 3.**

Response:

Noted change made on page 2-61.

3. **Add State Water Resource Control Board Resolution No. 92-49 to the list of action-specific ARARs.**

Response:

~~Noted change made on page 2-64~~. All reference to Resolution 92-49 has been removed from this document.

4. **Add State Water Resource Control Board Resolution No. 92-49 to the list of chemical-specific ARARs.**

Response:

~~SWRCB Resolution No. 92-49, which gives the RWQCB authority over cleanup of waste discharges that threaten the waters of California, incorporates by reference the non-degradation policy (68-16). Resolution 68-16 specifies cleanup goals for groundwater ranging from background conditions to applicable water quality objectives. Background conditions for all VOCs detected in groundwater are considered to be a level of 0.5 µg/l. The applicable water quality objectives are the MCLs. The background and MCL values represent chemical specific ARARs for groundwater contaminants at the Davis site.~~ All reference to Resolution 92-49 has been removed from this document.

HQ AFMC/SGB, Colleen Lovett's Comments on the Draft Interim Record of Decision Davis Global Communications Site, McClellan Air Force Base

1. Page 2-35. For future pathways, did you evaluate ingestion of plants/produce irrigated with contaminated water?

Response:

Health risks were not quantified through this exposure pathway for the hypothetical future land use scenario developed for the risk assessment for the Davis Site. A future resident could conceivably obtain produce from a backyard garden, irrigated from a private well that draws water from contaminated groundwater. However, exposure through the produce ingestion pathway is likely to be very small, compared with the other pathways considered in that exposure scenario, for these reasons: 1) concentrations of VOCs in groundwater used for irrigation would undergo significant attenuation prior to uptake into plants; VOCs would tend to volatilize from water and soil before uptake into plants, reducing the concentration that could be taken up into plants; 2) The VOCs detected in groundwater at the Davis Site have little tendency to be taken up from soil into plants because of their physical and chemical properties. Soil to plant transfer is proportional to the octanol-water partition coefficient (K_{ow}) of a chemical (to some extent, chemicals with higher K_{ow} values have a greater tendency for plant uptake). The VOCs detected in groundwater at the Davis Site tend to have low K_{ow} values. EPA risk assessment guidance states that this exposure pathway may be relevant only for a small number of sites and contaminants (i.e., pesticides and metals), and should be evaluated when the assessor has site-specific information to support this as a pathway of concern for the residential setting (EPA, 1991; *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, "Standard Default Exposure Factors"*. OSWER Directive 9285.6-03; March 25, 1991). There is no literature information indicating that soil to plant uptake of VOCs has been an exposure concern, and no information from other sites with groundwater contamination with VOCs suggesting that this pathway has been a prior concern.

Reviewing Office: Public Affairs, Kay Parson's Comments on the Draft Interim Record of Decision Davis Global Communications Site, McClellan Air Force Base

1. **PAC-1. General–Please provide public notification/involvement in accordance with AFMC Public Affairs Environmental Handbook, AFMC Pamphlet 190-5, Pages 48-51.**

Response:

A response to this comment will appear in the Final IROD.

2. **PAC-2. General–Suggest incorporating the Restoration Advisory Board (RAB) requirement in 2,3, Highlights of Community Participation.**

Response:

A response to this comment will appear in the Final IROD.